VOLUME XLI

QUEENSLAND AGRICULTURAL JOURNAL

Issued by direction of

The Hon. the Secretary for Agriculture

Edited by J. F. F. REID

JANUARY to JUNE, 1934

ANNUAL RATES OF SUBSCRIPTION.

Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling.** Members of Agricultural Societies, **Five Shillings,** including postage. General Public, **Ten Shillings,** including postage.

QUEENSLAND AGRICULTURAL JOURNAL

VOL. XLI. | 1 JANUARY, 1934. | PART 1.

Event and Comment.

The Lamb-Raising Industry.

WITH the prospect of developing a Queensland export trade in fat lambs to the extent of at least 500,000 carcasses per annum, the Minister for Agriculture and Stock (Mr. F. W. Bulcock) has arranged for the introduction of English types of rams, which will be used for experimental purposes on the Darling Downs and on farms below the Range.

Arrangements have been made with the Brisbane Abattoir to treat the lambs so produced and to report on their condition. Reports from Smithfield when the carcasses eventually reach that market will also be supplied.

Mr. Bulcock is keenly interested in the possibilities of the lamb-raising industry. In the course of a Press interview he said that a conservative estimate placed the export figure at not fewer than 500,000 lambs per annum. The chairman of the Queensland Meat Industry Board (Mr. E. F. Sunners) had given very close attention to the matter, and had made the estimate, which was fully supported by other inquiries.

Queensland in the past had paid too little attention to the raising of the type of fat lamb for which there was a ready market overseas, added Mr. Bulcock. Recently experiments had been decided upon by the State Government in an endeavour to determine the right cross-breed type in various districts of the State. Up to the present rams of the Southdown, Border Leicester, and Romney Marsh breeds had been purchased. Now it had been arranged to buy more rams of British breeds in the Riverina district of New South Wales.

Arrangements had also been made for the use of a property at Cambooya as a receiving depot, and all rams from the South would be received there. They would be sent by arrangement to the sheep farmers to whom rams were being allocated. The Romney Marsh would be the only breed allotted to farmers below the Range, and the Border Leicester, Southdown, and Dorset Horn, and, to a limited extent, the Shropshire also, would be placed on the Downs.

Two farmers in each district had been selected for the purpose of carrying out this experimental work, Mr. Bulcock added. It was desired that any farmer who received rams under the plan should take two or three breeds, so that comparative data might be obtained. The plan would be extended to other districts as opportunity offered.

Hitherto fat lambs have not figured very largely on outward manifests from Queensland ports, so Ministerial policy in this connection will be commended by all interested in the further development of our export trade. A recent investigation shows that Queensland ought to be able to export at least 500,000 carcasses of fat lambs annually. Of more than 3,000,000 carcasses sent from Australia for the year 1932, Queensland contributed only 23,000; and two years before that shipments were as low as 11,000. Our seasonal conditions favour the fattening of lambs and landing them on the British markets before the early spring arrivals from any other part of the Commonwealth; and market reports show that early lambs always command a high price. To get the best results it is essential that the right type of lamb should be produced, and the methods chosen by the Minister are commended in commercial circles, as well as by many people engaged actively in or associated directly with rural enterprise. His proposal to co-operate with selected farmers in different districts in experimental and demonstrational work will have the effect of stimulating both individual and general local interest, and of ensuring the success of the project.

The Rise in Wool.

ALTHOUGH the pastoral industry has had to face disastrous losses in both the paddock and the market during the last few years, the rise in wool prices, together with a bountiful season in most grazing districts, has altered the whole outlook, especially for those who are able to replace their sadly depleted flocks. It will be a long time yet, however, before the industry can recover from the effects of the economic blizzard, but the improvement in the wool market is a happy augury of better times. What the increased prices for wool means to Queensland is very impressively set out in a recent review of our pastoral year. Based on the estimated output for 1933-34, and an estimated average of £20 a bale, the increased prices mean more than £3,000,000 yearly if values hold.

It is difficult, however, to estimate the value to the State and the Commonwealth of the improved market, because the selling season is only half way through. But on present figures, allowing for a substantial shortage due to adverse seasonal conditions, the Queensland output of 476,000 bales of greasy wool (including all shipments) may be estimated at £20 a bale gross, representing a return of £9,520,000, as against 500,523 bales for 1932-33 for a return of £6,499,561. This would, therefore, mean an improvement of more than £3,000,000 for the year. On the same basis, the whole Australian clip, approximately 2,823,700

bales, will probably return £56,000,000, compared with £35,043,054 for last year. To quote from the review referred to:—

It is particularly pleasing to be able to show, by means of the average prices for the last three years, and for the six sales that had occurred during the first half of the 1933-34 season, the excellent recovery that wool prices have made. This is an improvement to be welcomed more especially in view of the disastrous times the producers have been through. Many of them had experienced heavy losses and were not in a position to restock. With the present exceptional season through Australia the outlook for a good increase in the total number of sheep is good.

In view of the better prices now ruling, it is of interest to look back over the last few years, to weigh the past with the present. The prospects have already been indicated. From the official records of the Registrar-Geenral (Mr. G. Porter), and from statistics compiled by Dalgety and Co., Ltd., information of interest to all sections of the community is available. For instance, in the peak period of 1925-26 the State wool clip from 20,663,323 sheep realised £13,146,356 (average price a lb—greasy 26½d., scoured 46d.).

Wool prices have been at a very low level for some years. To emphasise this it is necessary only to quote the average prices a lb. of wool for the years under discussion. Last year the average was a shade over 9d. a lb. For 1931-32 it was 8·61d., and for 1930-31 it was 9·86d. These averages provide an astonishing contrast with the 1925-26 averages—greasy 26½d., scoured 46d.

This year, beginning with the first sale in June, a steady increase in the average price, as well as in the highest prices, occurred. These averages improved from 11d a lb. for greasy and 18·89d. for scoured wool, to 16·9d. and 27·55d., respectively.

The highest prices—which are never so good a guide as the averages—improved from 16¾d. and 26½d. to 25d. and 40¼d., respectively.

A pleasing feature of these increases is that they represent no sudden jump, but a gradual improvement, which, it is hoped, may continue, or at least remain steady.

The Agricultural Outlook.

REVIEWING the agricultural situation generally at the end of the year, the Director of Agriculture (Mr. A. E. Gibson) said in the course of his remarks that the outlook for the agricultural industry in Queensland this year is particularly bright from a production point of view.

The maize-growing areas of the State had received a thorough soaking, the spring crop was fast approaching maturity, and conditions were all that could be desired for the standing corn.

Summer fodder crops were looking well, particularly the sorghum varieties and panicums. Farmers should seize the opportunity to conserve surplus growth which it was reasonable to suspect would not be required for purposes of autumn stock feeding, in view of the flush growth at present noticeable in the pastures.

The Minister's New Year Message.

To the

FARMERS OF QUEENSLAND

RECENTLY I heard a traveller of wide-world agricultural repute refer to our farming community as "Australia's sturdy yeomanry." It was, I think, an apt phrase, rich in historic associations, and expressive of our heritage of determination and resolute courage. These attributes have been in clear evidence during the year just ended. Hope and disappointment have alternately held sway over our farming population, but rarely has despair assailed us.

A courage carrying with it a vision of the future is slowly but surely being justified, and we may look forward to happier times during the coming year.

The most notable achievement of the year in rural economics was the stabilisation of dairy products, and this should prove the forerunner of a general Australia-wide stabilisation policy based on Australian standards.

The past year witnessed a steadily growing world-wide movement towards the maintenance of economic security for our farming peoples, and we may reasonably anticipate rapid and beneficial readjustments as soon as the necessity for them is clearly demonstrated.

On behalf of the staff of the Department of Agriculture and Stock and myself, I wish the producers of the State health, security, and contentment during the coming year.

Frank. W. Bulcock

Banana Thrips and the Problem of Its Control.

By J. HAROLD SMITH, M.Sc., N.D.A., Entomologist.

(Continued from page 524, Volume XL.)

Sulphur and Nicotine Dusts in the Control of the Banana Thrips.

THE possibilities of inert dusts for the control of the banana thrips have been thus carried to a stage at which there appeared to be no material advantage in pursuing the subject further. One other line of inquiry, however, seemed to warrant investigation, this being the utility of sulphur dusts.

In recent years entomologists have paid some considerable attention to the quality of the sulphur dusts used for insecticidal purposes, and have consequently dispelled some of the confusion previously associated with their action. These developments have led to an improvement in the commercially available supplies, although the products are hardly yet sufficiently standardised. For present purposes, the following points are significant:—

(*a*) That the principal toxic to both insects and fungi is gaseous sulphur. Other probable constituents in an atmosphere bearing particulate sulphur may be sulphur dioxide and hydrogen bisulphide, but these have been shown to be relatively non-toxic on ordinary concentrations such as are found in the field.

(*b*) That atmospheric conditions limit the toxicity of the dust. The chief among these would be temperature, which is said to determine the production rate of the volatile derivatives given off at the higher temperature range. In the view of some workers, humidity is also a conditioning factor, but Goodwin and Martin, working under controlled laboratory conditions, demonstrated that varying humidities make no appreciable difference in the rate of volatilisation at the same temperature. Other factors have been also suggested, but the contribution of these is negligible except in so far as they alter, directly or indirectly, the temperature at which volatilisation takes place. The temperature influence may help to explain the contradictory reports circulated by users of sulphur dusts, and to evaluate any worth which they may possess. Using deposition of stains on copper as the index to the rate of volatilisation of sulphur, Goodwin and Martin showed that at temperatures above 100 degrees Fahr. the increase in the rate of generation of sulphur fumes is very rapid. Confirmation is obtained in the field by the fact that it is invariably in regions of high temperatures that sulphur finds a niche in entomological practices. Thus, in California sulphur dusts are requisitioned in quantity for the control of the citrus thrips, a pest of some notoriety in that State. In view of this it would seem that, given good-quality sulphur dusts and similar temperatures, comparable results would be obtained in other parts of the world.

Great strides have been made in the manufacture of sulphur dusts during recent years, and significant developments are pending. This trend is outlined by De Ong and Huntoon. Working on the assumption that the inherent value of sulphurs depends on the state of subdivision, improvements in grinding methods have been introduced, and to-day very fine grades of ground and sublimed sulphurs are procurable in Australia. Precipitated sulphur, which has attracted some interest, is obtained by a variety of methods during the extraction of illuminating and oil refinery gases. The method of precipitation controls the particle size. Fineness is probably their greatest asset, and some experimental work has been carried out which indicated that this form of sulphur was worth investigating for the control of the banana thrips. Laboratory and field experiments were accordingly initiated.

Laboratory tests preceded and determined the scope of the subsequent field work. Initial stocks of precipitated sulphur were purchased locally, the sample procured showing greyish-green characteristics. The laboratory trials were arranged in the same manner as adopted in the trials of inert dusts, with the slight but significant difference that at least one-third of the individuals in each colony were adults. The establishment of the colonies on dusted fruits was anything but an easy matter, for both immature forms and adults tended to leave the fruits on which they were placed and wander over the walls of the glass container. The younger forms were particularly sensitive and their survival value was consequently low, but some larvæ and a few adults kept the colony intact for a few days. Ultimately, within a week, the colony if not exterminated was reduced to dimensions insufficient to cause rusting on the surface of the fruits. On the check fruits the initial colony throve for some time, and at the end of a fortnight or so its numbers were increased through the addition of first-stage larvæ hatched from eggs laid in the fruit subsequent to the establishment of the colonies. No parallel phenomenon occurred in the sulphured fruits, though eggs had been laid in the rind. It can hardly be supposed that the sulphur would have an ovicidal value; hence it is more probable that the physiological role of the sulphur is to inhibit the effective emergence of the larvæ at the time of eclosion from the egg. Such observations as those provided by closed containers can hardly be translated into the field—there are decided differences in the two habitats; but they indicate that under certain positive conditions some forms of sulphur may play a useful role in the control of the banana thrips.

Preliminary trials in the field during the same summer confirmed the observations in the laboratory. Here the sulphur dispersed individuals in the colonies from the base of the hands, the insects shifting to the tips of the fruits. After dispersion, colonies were not re-established, and it seemed certain that the numbers, particularly of the first-stage larvæ, had been considerably reduced, either by death *in situ* or by dropping off the fruit. The dust used in the field on this occasion was identical with that handled previously in the laboratory, and the results were for the most part comparable.

From these preliminary results, wider work in the field seemed desirable on a scale sufficiently large to estimate the value of precipitated sulphur and some other selected dusts, not on the thrips infestation, but rather on the rust incidence which forms the economic significance of the pest. One consideration which hampers the critical evaluation of

any insecticide applied to the banana bunch is the impracticability of accurately measuring the rust incidence. There may be variations from bunch to bunch and from hand to hand within the one bunch; there may be discolouration without splitting should thrips attack be delayed, or splitting without marked discolouration should early infestation be heavy and growth rapid. Still, as the thrips population, for reasons already set out, is not an index of the economic significance of the pest on any particular plantation, an attempt must be made to measure rust in some intelligible terms. Without this any opinion on the worth of control measures depends entirely on the observer's ability to translate his own visual appreciation of any given rust appearance to other people.

For the purposes of the field work about to be described, an effort has been made to classify bunches when harvested on a basis of rust incidence, each individual bunch when cut being placed in one of the following categories:—

A.—Bunches in which the discolouration, if any, is restricted to the base of the fruit; blemishes insufficient to affect the value; assigned numeral—1.

B.—Bunches with rust along the sides of the fruit both at, and away from, the base of the fruit, though with no signs of obvious cracking; mild infestation of the bunch with extended discolouration due to the phenomenon of fitting between adjacent fingers; assigned numeral—2.

C.—Bunches in which the cracking is superimposed on rust with a fairly extensive range; early thrips infestation followed by growth cracks on the feeding surfaces; assigned numeral —3.

D.—Bunches in which splitting has appeared on the surfaces of at least some of the fruits, while others are badly cracked; assigned numeral—4.

In connection with the marketing of these four grades of bunches, no waste would be found in the first group and very little in the second. C and D are definitely poor grades, the fruit in which would hardly warrant despatch to the southern markets unless ruling prices were exceptionally high. Good-quality fruit may sometimes be culled from some of the hands in grade C, though little could be salvaged from the poorer grade D.

These four categories are entirely arbitrary and inevitably express a mean for the bunch concerned in which, of course, the rust incidence of the fruit in each hand will vary. In classifying the bunches on the above basis it was found that the condition of the upper four hands determined the quality assigned to individual bunches, for unless abnormal conditions supervened—*e.g.*, fruit fly infestation and the use of stockinette for protection—the terminal hands included some saleable fruit. Most of the larger and better filled fruits in the basal hands suffer more severely from rust than the slower maturing fingers in the terminal hands, and the total loss on this account may be considerable. Some growers tend to wait till the lower hands are thoroughly filled before cutting the bunch, and in doing so often sacrifice the good fruit in the upper hands for that of inferior quality in the lower. In the present work the fruit was cut as early as was compatible with reasonable maturity.

As stockinette sleeves tend to aggravate the rust incidence in the bunch from a given thrips population, no special precautions were taken against the fruit fly, hence losses from this cause were anything but negligible, and as might be expected the occurrence of split fruits through the plantation increased the losses due to this pest.

The plantation was regularly laid out, and two acres with a south-easterly aspect bearing stools just about to bunch were selected for the work. The plants had been well tended, weed growth being kept down to a minimum and the old leaves stripped regularly. The soil type was akin to that associated with the more destructive outbreaks of thrips rust in the north, being reddish in colour, volcanic in origin, and typical of many of the foothills along the North Queensland coast. No fruit had been cut prior to the first dusting, and 454 bunches were traced through their whole development from the time of inversion to cutting. The systematic examination of these at weekly intervals allowed regular observations on thrips activity during the summer months, the development of rust in relation to thrips population, and the influence of bunch conformation on rust incidence.

Two areas were selected, each comprising approximately one acre, and rows in these were mapped out on a system suitable for field experimental work, so that each row subjected to a single treatment represented a single plot. Thus in the first area there were 16 plots with quadruplicate treatments of three dusts and equivalent checks, while the second held 12 plots with triplicate treatments and the necessary checks. In the former, treatments were made weekly and in the latter fortnightly. Each plot in the first area carried some 12 to 19 recordable bunches in the row, while the larger plots of the second area ranged from 27 to 43 with the majority round the 30 mark. The discrepancy in the number of bunches matters little, for any conclusions which may emerge from the work will be drawn from both qualitative and quantitative data. The arrangement of the work on quantitative lines tests the method in this class of work, while the incidental semi-random distribution of the plots reduces, or ought to reduce, differences in rust incidence due to variable bunch conformation ascribable to scrub shade, subsurface drainage, &c.

Three dusts were submitted to comparative tests:—

(*a*) *Nicodust*—a proprietary brand containing 2 per cent. of nicotine as nicotine sulphate with hydrated lime as filler.

(*b*) Precipitated sulphur showing the following analysis:—

	Per cent.
Sulphur	97·2
Ash	2·1
Chancel degree of fineness	82

The sample used in the preliminary trials had the constitution—

	Per cent.
Sulphur	99·6
Ash	·2
Chancel degree of fineness	85

but apart from its greater purity and better particulate form, there was quite a difference in the colour of the two types. The preliminary sample was greyish-green, very different from the bright yellow mass appearance characteristic of the bulk supplies used in the large scale field experiments now under discussion.

(*c*) Nicodust and precipitated sulphur in the proportions 2 : 1, being mixed immediately before using.

All three dusts were applied to the plants by means of a rotary dust gun fitted with a flexible arm, the construction of which is detailed in Appendix IV. The fishtail feed gave an even charge, while the manipulation of the apparatus involved no difficulty.

In evaluating the effects of any particular treatment, the rust incidence values for each plot were determined as shown in Appendix III., using as a basis for calculation the numerals assigned to each bunch at the time of cutting. The four categories A, B, C, and D carry the values 1, 2, 3, and 4 respectively, hence in the estimate for the value of any particular dust, an assigned value of, say, 1·5 would indicate that the value of the bunches lay midway between categories A and B.

The summary values given to each treatment in the two areas at the conclusion of the work were as follows:—

—	Area I. (Treatments Weekly.)	Area II. (Treatments Fortnightly.)
Nicodust	1·7	2·3
Nicodust and precipitated sulphur	1·8	2·2
Precipitated sulphur	2·1	2·4
Check rows	2·5	2·1

The nature of the data is such that any statement of the calculated standard error would mean very little, but the summary statement is suggestive. In the weekly treated area, the maximum rust incidence per plot occurs when bunches are untreated, and the minimum is found when nicodust is used. On the other hand, fortnightly treatments with any of the three dusts effected no noticeable improvement. In discussing the pros and cons of quantitative data, a number of considerations have to be kept in mind which concern the different conditions in different parts of the plantation during the season. Of the two areas, that dusted fortnightly occupied the upper end of the slope, while the other abutted against a gully at its lower end. For sundry reasons, probably associated with drainage, the stools growing in the vicinity of the gully possessed a more vigorous growth than the remainder of the plantation, and bunching difficulties which were general through the plantation in January were less accentuated there. The season was somewhat exceptional. Normally, summer rains commence in late December or early January, but in the summer of 1930-31, exceptionally dry, hot weather continued until the end of January. Bunches thrown during this dry spell in the first three weeks of the month were invariably badly rusted, not on

account of a larger thrips population than that of the early and late thrown bunches, but following compaction of the hands and delayed inversion. Those in the upper part of the slope showed the abnormalities to a very marked extent. Such bunches are always difficult to dust properly, and they introduce added variations from bunch to bunch in the efficiency of their individual treatments. Another disturbing factor was introduced into the plantation in February, when a virulent form of leaf spot swept through part of the area, commencing in the gully region adjoining the scrub and working outwards.

The interaction of all these factors on the data does not, however, obscure some of the more obvious conclusions emerging from the work. The chief among these are—

(*a*) If bunches are thrown normally, weekly dustings with nicodust do minimise losses due to the banana thrips, even when the pest is more than normally destructive. Conversely, if bunches are thrown abnormally, dusting, no matter how efficiently carried out, is incapable of adequately coping with the trouble.

(*b*) Precipitated sulphur used either weekly or fortnightly gives no appreciable control over the banana thrips under conditions of heavy infestation, while no advantage is secured by combining the nicodust with the brand of precipitated sulphur used.

(*c*) The general health of the plantation is a necessary basis for thrips control, without which any supplementary measures can only be of limited value.

The disparity between the results with precipitated sulphur in the field and in the laboratory is somewhat striking. Normally it is accepted that the toxic properties of the dust depend entirely on the generation of gaseous sulphur, the rate of generation being controlled by ruling temperatures. The dust is consequently most used in countries characterised by high day temperatures during the pest-active season. In coastal Queensland, the shade temperatures during the summer months vary between maxima of 80 and 100 degrees, sometimes going above the latter, though not for any considerable length of time. The lower temperatures are common during the wet periods, and the higher when dry conditions suitable for dusting occur. These shade temperatures, however, give little indication of the real conditions in the bunch habitat, for it is quite exceptional to find the whole of the bunch under shade conditions. Hence in any one bunch, part may be in complete shade while the remainder is exposed, and the mean effective temperature over the whole bunch would be much higher than either of these figures, at least during the spells of fine weather. The rate of generation of gaseous sulphur increases rapidly when the temperature rises to 100 degrees Fahr., and bunches grown in the North ought to respond to treatment, for the temperatures are within the limits required for the rapid generation of the fumes. Apparently the presumption does not hold for the quality of the dust used.

Any discrepancy between the results in the field and those in the laboratory with any one sample of precipitated sulphur may be ascribed to dissimilarities in the two environments. In a glass cylinder kept indoors there would be no air currents to waft away fumes which

would otherwise accumulate to a concentration toxic to the insects. But the more important discrepancy, however, is not that between the field and laboratory data—it is rather the vastly different results from field trials with two different samples of precipitated sulphur, only one of which had been used in the laboratory. A difference of this kind must depend on the quality of the dusts used. There are therefore two factors which together or independently may shed light on the observed data, the first concerning the absence of air currents in the laboratory, the other the quality of the dusts used. The former requires no special elaboration.

The samples of precipitated sulphur used in the earlier phases of the work were greyish in colour, in contrast to the bright yellow of the bulk supplies purchased at a later date. Variations in the colour of different brands of sulphur are usually put down to the nature of the impurities in the sample, but their association with the insecticidal value of the dusts is indicated by the following quotation from a paper by De Ong and Huntoon:—

> "The grey colour of the sulphur recovered in the gas-purification process favours sublimation at low field temperatures. This principle has long been recognised in France, where dark-coloured sulphurs are chosen for early spring work on the control of mildew."

Attempts to elucidate the chemical basis behind the practice have so far met with no success, but the point may prove to be of interest not only in connection with the explanation of the current experimental work but also in connection with the standardisation of dust for insecticidal and fungicidal requirements. At present the relative merits of the various sulphurs are supposed to depend entirely on the particulate size of the samples, following the assumption that gaseous generation is proportionate to the surface area exposed. Perhaps other factors are of equal importance. Two problems would thus seem to emerge from the work on sulphurs—

(*a*) What are the distinctive principles of the grey-coloured sulphurs which encourage the sublimation at comparatively low temperatures? Such sublimation may be due to some special impurity from a particular method of manufacture, but, in any case, it is a chemist's rather than an entomologist's problem.

(*b*) Is the particulate size of any sample of sulphur an accurate index of its toxicity over the whole temperature range?

It has been impossible to get supplies of precipitated sulphur comparable to those used in the first instance, and for that reason work in the field has been suspended; but even were they available, the two questions should be answered before it can be profitably resumed.

The losses in the plantation as a whole through rust were consistently high, except in those plants treated weekly with the nicodust. If the bunches when first completely exposed were clean, they could be kept clean. The values assigned to the bunches indicate the real value of repeated dustings, though they probably under-estimate it, for the arbitrary numerals assigned to bunches of different quality tend to lessen the statistical influence of the best and exaggerate that of the worst fruit.

The main objection of the grower hinges on the cost of the operation. There is some ground for this criticism, though actually the economic justification of dusting depends on the anticipated value of the fruit when marketed. It is rather unfortunate, therefore, that fruit grown during the summer when some control measures are imperative should be sold at prices depressed by the seasonal influx of other fruits to the principal markets. The advisability of dusting is, however, a matter for the grower to decide after weighing all probable eventualities. In most plantations the expense of the insecticide would not be the determining factor. It is rather the cost of the necessary labour, which can be very considerable when repeated dustings are required. This item in the cost has, in the past, been particularly high because the available dusting apparatus, designed for other purposes, is in many respects quite unsuited for the bunch treatment of the banana plant. Bulb blowers or small dust guns have both been used, but the hopper capacity of each is limited, while the thorough dusting of any series of bunches requires some agility on the part of the operator. The device used in these experiments is a considerable advance on either of these, though, even so, it is crude and capable of improvement. It consisted of an ordinary rotary duster in which the feed arm was converted from the rigid to the flexible form. This permitted a dust discharge in any desired direction, while the ordinary mechanics of the duster ensure a more even dust cover than any other method. The time necessary to treat individual bunches is correspondingly reduced and the incidental labour charges with it. Even so, the cost of dusting remains admittedly high, but an observant grower can still further reduce it by adjusting his dusting to the precise needs of his plantation. No good purpose is served by dusting bunches before the bracts loosen, and little before they are shed from the bunch. No remedy can be prescribed for injury prior to this stage, but adequate dusting at the bract-shedding stage will inhibit further thrips development and minimise the injury accordingly. Systematic dusting may then keep the thrips population within reasonable bounds.

In this series of field experiments, only a nicotine dust in which nicotine sulphate furnished the toxic ingredient was used. Nicotine sulphate is very convenient from the manufacturer's point of view, for it is a standardised product which lends itself to the preparation of dusts with a given nicotine concentration. From the entomological point of view it has, however, certain drawbacks. When exposed, free nicotine is given off, the rate of evolution varying with the temperature at the time of application. The rapid evolution of nicotine fumes is very desirable in the control of the banana thrips. Dusts in which free nicotine is substituted for the nicotine sulphate liberate toxic fumes more rapidly than those containing nicotine sulphate, and thus better meet the special requirements of this problem. A comparison of both types of dust in the field has shown that these free nicotine dusts have a greater value for the control of the banana thrips than the nicotine sulphate dusts in common use throughout the State. It is therefore suggested that if the incorporation of free nicotine in dusts can be effected without interfering with the desired standardisation of the insecticide, manufacturers would be well advised to make the substitution.

In the summer of 1929-30 experiments with a mixture of a free nicotine dust and precipitated sulphur showed rather promising results in the field. These prompted the inclusion of similar trials in the

summer of 1930-31, but the results as just recorded are disappointing. Subsequent inquiry into the quality of the dusts showed a difference in the alkalinity of the two samples of sulphur, one being neutral and the other alkaline in their respective reactions. The alkalinity of the second sample of sulphur would depress the toxicity of the nicotine dust, and the disparity of the two results may be attributed to this cause, together with differences in the quality of the sulphur used. There is, however, no reason to suppose that such a compound dust with ingredients possessing the desired specifications should not be an improvement on the nicotine dust when used alone for the control of the banana thrips if the prices are comparable. The independent effect of the sulphur should be apparent after the toxic properties of the nicotine have been exhausted. Further work on this subject is much to be desired.

GENERAL DISCUSSION.

From the data presented it may be practicable to summarise the work, discuss its implications on the larger question of control, and restate the problem for the future. It has been pointed out that the general health of the plantation furnishes a fairly good indication of the possible worth of even the best control measures formulated. If this is at a low level, abnormalities in bunching and rates of bunch development both increase the period of pest effectivity and limit the utility of any dusts which may be used. It may be a mere coincidence that the extension of rust incidence through the State in recent years has coincided with the general deterioration of many plantations. But in view of the early discussion of the factors which tend to increase the losses in the fruit due to the banana thrips, there would appear to be strong grounds for supposing that there may be some relation between the two events. Some years ago the life of a plantation covered a profitable period of from four years upwards, but to-day very few plantations last for even four years. Various explanations have been suggested—the cumulative effects of pest and disease organisms, the transition of plantations from good to poorer types of soil, the widespread incidence of root failure and, perhaps, stock deterioration. There may be a certain amount of truth in all these, but from the present viewpoint their cumulative effect is to introduce growth conditions more favourable to thrips activity than would otherwise be the case. The tacit association in the south of thrips activity with dry weather conditions may again be a reflex of the same thing. One is too apt to assume that acute rusting in any district is associated with an epidemic of the pest. It may be partly so, but the precise conditions which are said to favour such hypothetical epidemics are precisely those which induce morphological aberrations in the plant, themselves sufficient to accentuate the injury caused by any given thrips population. The southern experience in 1931 is a case in point—a severe dry spell synchronising with unprecedented rust over a great part of the commercially producing areas, and at the same time producing all the abnormalities previously described in some detail.

The work has so far been confined to dusts which are cheap enough to be adopted in plantation work if they are sufficiently effective to make any appreciable contribution to the control problem. The supposed efficacy of some stomach poisons is found to be an attribute, not of the toxic constituent but of the physical properties belonging to the dust or spray deposit, these probably inhibiting the free movement of the insect.

The studies on this phase of the subject do not indicate any great possibilities for inert dusts as at present available. An improvement could no doubt be effected if the dusts were applied in fluid media to which spreading materials had been added, but the practical obstacles seem insuperable. Until some means are devised for increasing the adhesion of such dusts to the surface of the fruit, no further progress seems possible. The problem has been recently broached in America in another connection, and oil fluids are incorporated into the dust for this purpose just before application. The manufacturing difficulties are, however, of some moment, for though, perhaps, simple when the requisite mixing plant is available, they can hardly be duplicated in Queensland banana plantations. It will be interesting to follow developments in this field of research, for they cannot but impinge on the local problem, even though inert dusts are themselves relegated into the background. If such improvements could be introduced for, say, nicotine dusts, they would serve a dual purpose—first in the destruction of the thrips, and second in restricting the pasturage of any colonies which may subsequently be established. At present, however, no good purpose is to be served by farmers applying inert dusts in preference to others which are known to have definite toxic properties.

Of these, dusts with a nicotine content are most important. Even under conditions of heavy infestation far in excess of that common in the South, tangible control can be secured by weekly applications of the dust. Wider-spaced applications proved of little value when the infestation was heavy. It is probable, however, that under southern conditions, where the numerical incidence of the pest is normally less than in the North, fortnightly dustings may be useful, but without any experimental experience on the subject no definite opinion can be expressed. The labour costs incidental to dusting can be materially reduced and the efficiency of the treatment increased if the rotary duster modifications detailed in Appendix IV. are adopted. Without some such improvements, the labour costs can easily be excessive. Doubtless the device can be improved by engineers whose province it is to devise apparatus of this kind.

At the present time the bulk of the nicotine-containing dusts used in the State consist of hydrated lime in which is incorporated the required amount of nicotine sulphate. The adoption of the latter as a source of nicotine may be due to the standardisation of the supplies and the consequent simplicity of the manufacturing process. Actually, however, the toxicity of the dust is dependent on the rate at which the nicotine sulphate dissociates and liberates nicotine, the generation of which is accelerated at high temperatures. Better results are procured when free nicotine rather than nicotine sulphate has been used in the preparation of the dust, for the evolution of the fumes is more rapid and the toxicity consequently increased. It is suggested, therefore, that if the preparation of nicotine dusts with free nicotine is practicable, manufacturers would be well advised to make the substitution.

The utility or otherwise of sulphur is still an unsettled question, the present studies having led up to what are essentially chemical questions. Precipitated sulphur of an exceptionally high quality and a dull grey colour yielded very promising results in both the laboratory and the field. Subsequent work with a lower-grade precipitated sulphur gave results in no way analogous to these. There are two possible

explanations of the varying results attributable to the two forms. The analyses suggest greater purity and finer particulate dimensions in the better sample, and perhaps this in itself, by increasing the gaseous generation at any given temperature, would be a sufficient cause for the observed results. Peculiarly enough, it has been impossible to procure further supplies of the better type of precipitated sulphur. Those obtainable of equivalent fineness are quite distinct in colour, being bright yellow rather than grey. In the literature dealing with sulphurs there are occasional references to some of a greyish colour which are credited with high insecticidal properties. There has apparently been no attempt to explain the colour or to prove any association with the insecticidal properties of the sulphur, though it is assumed to bear some such relation. There is thus evidence that this colour has significance for the entomologist. Until this evidence is sifted, it must be assumed that particulate size alone determines the insecticidal properties of any given sulphur dust. This assumption has been responsible for considerable improvements in the manufacture of sulphur dusts, and specially treated sulphurs, ground, precipitated, and colloidal, are on the world market. Some of these may be useful for certain pests, but the prices quoted in Australia are often quite prohibitive so far as the control of the banana thrips is concerned.

Recommendations.

(*a*) Nicotine dust in which the toxic ingredient is free nicotine and the carrier hydrated lime has proved the most efficient of the dusts handled, and it is suggested that during the summer months growers should make the necessary provision for the treatment of their fruit. Dusting should commence immediately the bracts are shed; bunches may be dusted earlier, but there is no experimental evidence to indicate that any advantage is gained by doing so. If the cost of the operation is to be kept down to a minimum, the apparatus should be based on the principles outlined, the feed arm of the rotary duster being converted to the flexible type. With all nicotine dusts, the best results follow their application when temperatures are high, hence midday treatments should yield the best results.

(*b*) Cultural practices such as manuring, suckering, &c., should all be designed to induce favourable growth conditions when the bunches are being thrown. Where a grower may reasonably expect his plantation to last over a period of years, he would be well advised to make his winter and spring crops his main source of income if the suckering programme can be so arranged. His bunches would then be thrown in autumn and early winter when the pest is least active. Any decrease in the size of his fruit would be amply compensated by the better market prices ruling when such bunches are cut. The severity of thrips rust incidence depends very largely on the grower's ability to maintain vigorous growing conditions in his plantation by good cultivation and the control of subsidiary pests and fungi.

(*c*) It is very desirable that the chemist, working under controlled laboratory conditions, should investigate the conclusions which seem to emerge from the current work with sulphur dusts.

Summary.

(*a*) The banana thrips previously regarded as an exclusively northern pest has during recent years penetrated the major producing areas in the south. At present it seems to be distributed through the whole of the State, though not always associated with rust on an injurious scale.

(*b*) The disparity between the incidence of the pest and the loss induced by it is traced to abnormalities in the bunch. In the absence of the insect, these would be of no great significance; coexistent with it they aggravate the injury. The main types of abnormality are discussed and their relation to the pest described. It is suggested that the recent increase in the losses due to the pest is associated with a deterioration in many plantations.

(*c*) Some studies have been carried out in connection with the control of the pest by dusting. Inert dusts such as kaolin and talc are found under laboratory conditions to limit the pasturage of the pest on the surface of the fruit at given concentrations. Instances of partital control by lead arsenate may be attributed to the physical properties of the spray or dust cover rather than to the toxic properties for which they are generally used. The utility of inert dusts for the field is limited by their general lack of adhesion and the frequent precipitation during the summer months.

(*d*) Favourable results in the control of the banana thrips by precipitated sulphur have followed the use of certain brands characterised by a greyish colour and extraordinarily fine particulate size. Some others more commonly available yielded less favourable results, hence there would appear to be scope for further work on this subject. Even if standardised brands of the better class precipitated or colloidal sulphurs were available, the current prices at which they are quoted would make their use uneconomic.

(*e*) Weekly dustings with nicotine dusts have given a reasonable measure of control in cases of unusually heavy infestation. The nicotine-containing dust should, however, be compounded of free nicotine rather than nicotine sulphate. The economics of the measure largely turn on the labour cost of application and improvements in the usual dusting devices for the specific purpose of treating banana bunches are suggested.

Acknowledgments.

The many-sided aspects of a problem such as this have prompted discussions with specialists in other spheres on several occasions. The writer is indebted to the entomological and other staffs at headquarters for their constant collaboration, to field officers of the Fruit Branch for assistance in connection with the plantation work, and, not least, to the growers who have made their fruit available for treatment. To all thanks are tendered, in particular to the Chief Entomologist, Mr. Robert Veitch, whose appreciation of the difficulties inherent in the problem has been a constant simulus.

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APPENDIX I.

THE ARTIFICIAL INDUCEMENT OF THRIPS RUST.

The experimental material consisted of two bunches, labelled for the purposes of reference A1 and A2, the former having just shed the bracts, while the latter was submature.

Bunch A1: Basal hand—Direct pricking with dissecting needles.

Fruits—

(*a*) Pricking comparatively heavy with considerable sap exudation. Pustules formed at each point of injury, with the outer edge dull green, the median portion ochraceous, and the hilum reddish-black; pustules in proximity to each other may coalesce; exuded sap persisted as drops of a gummy consistency.

(*b*) Pricking moderately heavy with little exudation. Features as in fruits (*a*), but pustules smaller in size and congealed drops fewer.

(*c*) Pricking mild with no obvious exudation. Features as in fruits (*a*) but congealed sap absent.

Bunch A2: Basal hand—Direct pricking with dissecting needles.

Fruits—

(*a*), (*b*), and (*c*), as in bunch A1.

Pustules as in A1, but larger in the younger bunch; the reddish-black hilum was absent, the entire centre cap being ochraceous.

Remarks—

(*a*) The whole of one side of the fruits was treated.

(*b*) The differences between the two bunches are explicable on the assumption that injured tissues of the older fruits have not the recuperative powers of the younger, and do not exude sap so freely.

Bunch A1: Hand 2—Scraping with dissecting needles to a moderate depth.

Fruits—

(*a*) Dashes irregular in direction but regular in series.

Marks persisted as lip-shaped structures with the outer edge dull green, the fringe of the lip dark brown, and the cavity ochraceous.

(*b*) Dashes regular in direction and series along the length of the fruit.

As in fruits (*a*).

(*c*) Dashes irregular in both direction and series.

As in fruits (*a*).

Bunch A2: Hand 2—Scraping with dissecting needles.

Fruits—

(*a*), (*b*), and (*c*), as in bunch A1.

Essentially the same structures induced as in the younger bunch, but the colour graduations were less obvious, the ochraceous colour being dominant.

Remarks—

(*a*) The structure of the rind permits splitting in any direction corresponding to that of the injury.

(*b*) The mature fruits reacted less severely to equivalent injury than the corresponding younger fruits.

Bunch A1: Hand 3—Scraping with a V-pointed eye scalpel.

Fruits—

(*a*) Dashes irregular in direction but regular in series.

(*b*) Dashes regular in both direction and series.

(*c*) Dashes irregular in both direction and series.

In all these the subsequent appearance corresponded with that of hand 2, in which the dissecting needle was used for similar treatments.

Bunch A2: Hand 3—Scraping with a V-pointed eye scalpel.

Fruits—

(*a*), (*b*), and (*c*) treated as in bunch A1.

Subsequent appearance was that of the corresponding hand in bunch A1, except that the callus was almost entirely ochraceous.

Bunch A1: Hand 4—Rasping with a file at various pressures.

Fruits—

(*a*) Rasping heavy.

Surface colour varied somewhat from black to ochraceous.

(*b*) Rasped lightly, the injured surface being then treated with the point of a dissecting needle.

Much the same as fruits (*a*)

(*c*) Rasped lightly, then the surface treated with fruit sap.

As in fruits (*a*) and (*b*), but the sap left a glossy deposit on the surface if applied in sufficient quantities.

Bunch A2: Hand 4—Rasping with a file at various pressures.

Fruits—

(*a*), (*b*), and (*c*), as in bunch A1.

Remarks—

(*a*) The fruit sap was obtained from the junction of fruits to the bunch stalk.

(*b*) The differences in the colour of the calluses seemed to depend on the depth of rasping.

Bunch A1: Hand 5—Sap applications to the fruits.

Fruits—

(*a*) Direct application of sap from pseudostem.

No trace of any marks of any kind.

(*b*) Direct application of sap from the bunch stalk.

Larger globules grey in colour with dark edges; smaller brown with a semblance of rust colour at the edges.

Bunch A2: Hand 5—Sap applications to the fruits.

Fruits—

(*a*), (*b*), and (*c*), as in bunch A1.

Results essentially the same as in the other bunch.

Remarks—

In abstracting the sap from the bunch stalk, the flow from the younger bunch was much more copious than that from those of greater age.

Bunch A1: Hand 6—Injury to the fruit surfaces plus thrips body contents.

Fruits—

(*a*) Dissecting needle scratches over a restricted area, to which crushed body contents and fruit sap were applied.

Results comparable with those of hand 2.

(*b*) Erosion with sandpaper plus crushed thrips body contents and fruit sap.

Results comparable with those in hand 4.

APPENDIX II.

INERT DUSTS.

Two inert dusts were available, kaolin and talc, duplicate trials being made.

Half the fruit was dusted and then inserted in a glass cylinder with shade adjustments, so that the clean portion was in the better lighted end. During the dusting the part to be kept free from a deposit was protected by means of paper wrappers. A thrips colony was established on the undusted section of the fruit, each colony comprising some fifty individuals.

Bristol board was attached to stiff cardboard by means of drawing pins, and the surface stained black with Indian ink. By pricking with a needle the white surface underneath could be exposed. Separate square centimetre areas on the one piece of Bristol board were thus arranged in a series which contained the following number of regularly placed white intrusions on a dark background:—

50, 100, 125, 150, 175, 200, 225, 250, 275, 300, 350, 400.

In estimating the dust concentration on any given fruit surface, the binocular appearance of such a surface was compared with the graded Bristol board series for purposes of visual comparison. From the known concentration of white spots in the square centimetre of Bristol board, the dust concentration on the fruit itself could be inferred, the magnification of the binocular being known.

The kaolin series was first arranged on 24th December, 1929, and contained fruits in each of the following series:—The numbers refer to the fleck concentration on the equivalent square centimetre of Bristol board showing the same mass appearance as the dusted surface under binocular observation:—

Series of Fruits.	Concentration at Initiation.
1	White
2	300
3	250
4	150
5	100
6	75

In series 1, 2 and 3, no thrips ventured over the dusted surface, and rusting was limited to the undusted parts of the fruits. In series 4, the line of demarcation between dusted and undusted parts of the fruit was less definite on the under surface where the colonies tended to congregate. Fruits in the remaining series showed rusting on both the dusted and undusted parts of the fruit, for the introduced insects split up into two sections one of which remained on the clean area while the other crossed the dusted surface to form a colony at the other end. Any limitation of rust incidence was due to a direct influence on the movements of the insect.

The critical point, *i.e.*, the minimum concentration which effectively hindered the movements of the insects, was between 6,000 and 8,000 particles per square centimetre of fruit surface, but even at lower concentrations there was still a hampering effect on thrips movements.

In the series of fruits subjected to similar handling with talc, the dust concentration on the fruits in the several groups was as follows:—

Series of Fruits.	Concentration at Initiation.
1	350-400
2	200-250
3	150-175
4	125-150
5	100-125
6	50-75
7	Below 50

Only fruits in series 1 showed an entire absence of rusting on the dusted surface. Series 2 and 3 were transitional, the thrips tending to break across the margin between dusted and undusted parts of the surface. Attenuation of the dust cover below this point allows more or less free movement of the insect until in series 6 and 7 the dust covers had little or no influence on the activities of the insect. As some slight breakdown took place in series 2, the higher concentration 250 is accepted as the limit to the thrips activity on dusted surfaces. In terms of particle concentration this would be 10,000 particles per square centimetre of surface.

EXPLANATION OF PLATES 1 AND 2.

Diagrammatic drawings from sketches made in the course of one laboratory experiment. In each case the end marked "A" of the fruit was in darkness and the end marked "B" was exposed to light. End "A" of all treated fruit was dusted with kaolin to the median line, end "B" being undusted. The left-hand illustration of each pair shows the upper surface as the fruit lay in the tube, the right shows the under surface.

The shading indicates the outlines of thrips pasturage and is heavier where the rusting was more severe.

PLATE 1.

I. Untreated fruit.

II. Dusted, series 1; concentration white.

III. Dusted, series 2; concentration 300 per magnified sq. cm.

IV. Dusted, series 3; concentration 250 per magnified sq. cm.

PLATE 2.

I. Dusted, series 4; concentration 150 per magnified sq. cm.

II. Dusted, series 5; concentration 100 per magnified sq. cm.

III. Dusted, series 6; concentration 75 per magnified sq. cm.

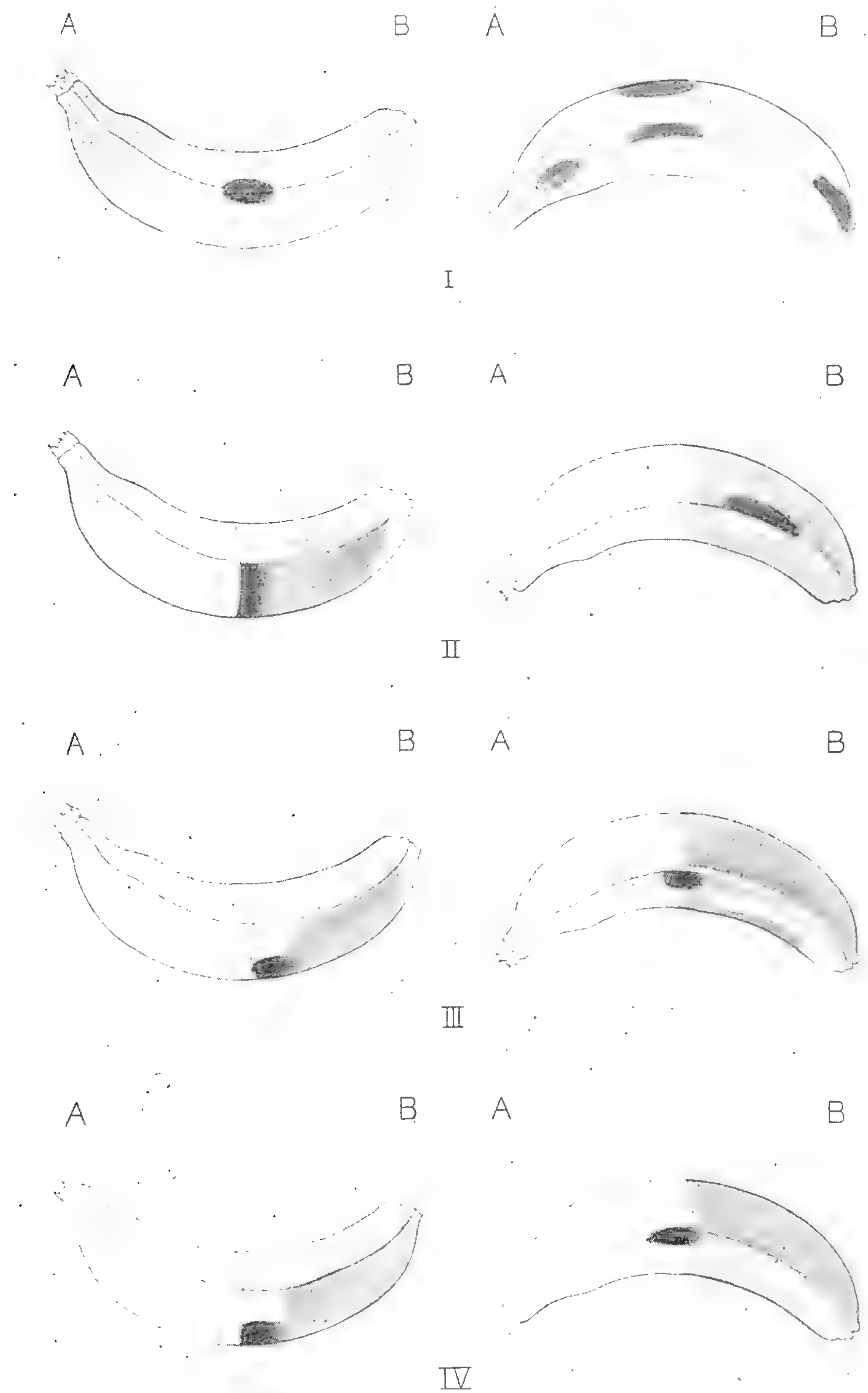
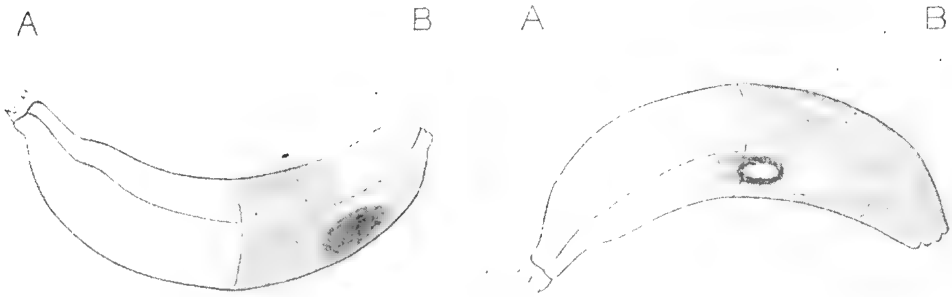


PLATE 1.



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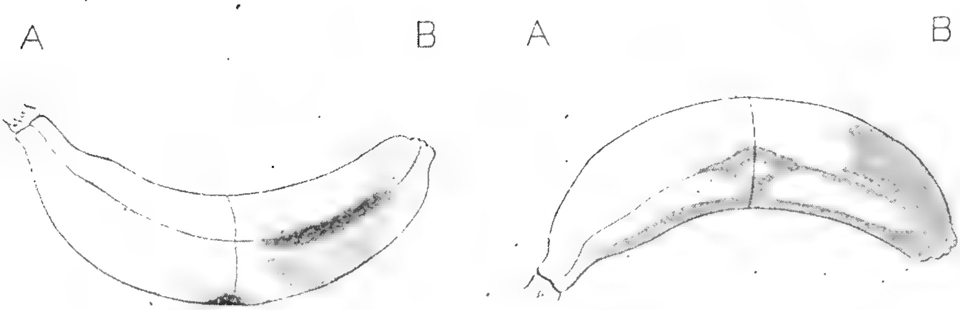

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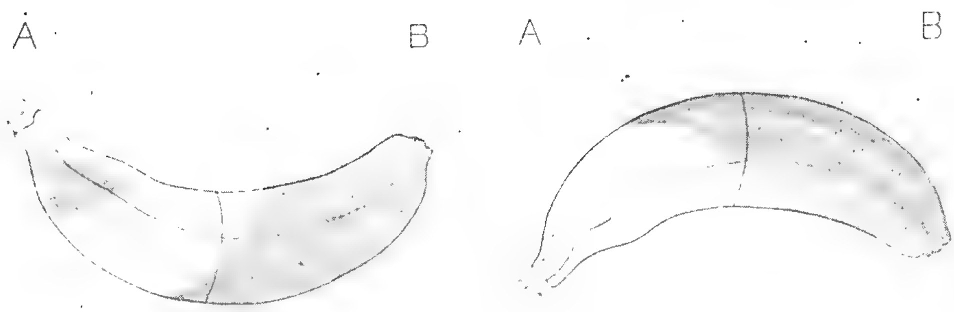

III

PLATE 2.

APPENDIX III.

THE UTILITY OF SULPHUR DUSTS.

Laboratory Experiments, 1929-30.

(*a*) Sublimed sulphur: Colonies were established on dusted fruits in confinement, 13th February, 1930. No obvious restriction on colony formation; little mortality during the first week and no inhibition of rust development. Eggs hatched normally after the usual period of incubation. After one month, the adults were dead but the colonies were intact, being made up of larvæ in the first introduced series and others hatched from eggs deposited in the fruit by introduced adults.

(*b*) Precipitated sulphur: Colonies were established on fruits, 18th March, 1930. Larvæ tended to wander from the fruit on to the glass, and all were dead within a week though some of the adults persisted. Eggs were laid by these, but none emerged except in the more lightly dusted fruits, where the increase in the larval population took place in the third week, *i.e.*, a fortnight after the same phenomenon in the checks. Rusting of any consequence took place only in the checks and lighter dusted fruits and then only towards the end of the observation period.

Preliminary Field Experiments, Edgehill, 1929-30.

(*a*) Sublimed sulphur, alone and in association with Cloudform tobacco dust, in proportions of 1 to 4. In the former no toxicity was observed, while in the latter case the effect was similar to that noted when the tobacco dust was used alone, *i.e.*, an immediate reduction in the existing thrips population followed by re-establishment some two or three weeks later from migratory individuals and young hatched from eggs in the fruit.

(*b*) Precipitated sulphur alone created conditions unfavourable to thrips activity on the bunch, hence the migratory but not necessarily fatal movements which follow dust applications. Adults showed a greater survival value than the larvæ, and egg-laying was not inhibited, though emergences did not take place as they otherwise did in the checks. In combination with tobacco dust in the proportions of 2 to 3, the thrips fauna was reduced to negligible proportions on the initial application. No trace of egg emergence at a later date. Reinfestation depended on the repopulation of the bunch some considerable time later. Normal emergences from the eggs took place towards the end of the observation period of five weeks.

Experimental material comprised 100 bunches in five rows, one of which was reserved for check observations.

It would appear from the above that the mixture of fine-grade precipitated sulphur with tobacco dust showed some possibilities for the control of the pest. Restocking of the bunch may occur from two sources, surviving adults or migratory forms from other parts of the plant. It appears that any eggs present in the fruit at the time of dusting, or laid shortly after dusting, do not hatch, or that the larvæ do not survive after hatching. Hence it must be supposed that adults which persist on the

dusted fruits continue to lay eggs, which first hatch successfully when the dust concentration falls below the toxic point.

Field Experiments, Little Mulgrave, 1930-31.

The plantation was located in the valley of the Little Mulgrave River, among the foothills of the fringing range on red volcanic soil. These soils carry a light rain forest. They possess little or no distinctive subsoil near the surface, and their moisture-retaining capacity is consequently low. At the inception of the work some 8 acres, planted in January, 1930, were coming into bearing, and actual observations extended from December, 1930, to June, 1931. The two areas selected for special treatments were chosen for their apparent uniformity. The aspect of the plantation was southerly and the general lay-out was as follows:—

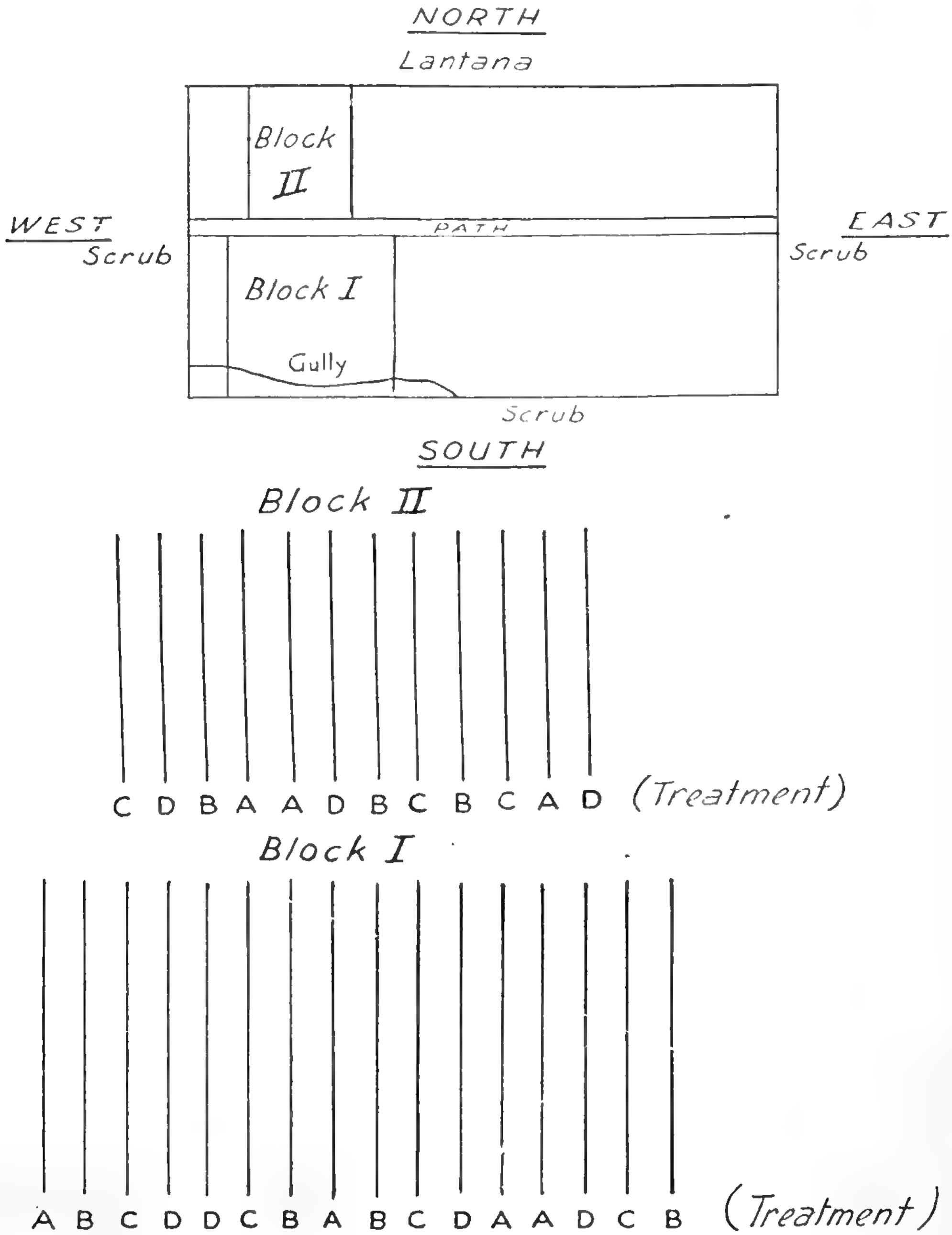

PLATE 3.

Treatments.—A: Precipitated sulphur; B: Check, untreated; C: Precipitated sulphur, plus Nicodust in proportions 1-2 respectively; D: Nicodust.

Block I.—Treated approximately at intervals of one week on the following dates:—December 16th, December 22nd, and December 30th, 1930; January 4th, January 12th, January 18th, January 26th, February 2nd, February 8th, February 15th, and February 21st, 1931.

Block II.—Treated approximately at intervals of two weeks on the following dates:—December 16th, and December 30th, 1930; January 12th, January 26th, February 8th, and February 21st, 1931.

In the following tables the date of bunching recorded is actually the date on which bunches thrown during the previous week were first marked. Bunches listed under "Pre. Dec. 10" were thrown earlier than December 3rd.

Block I.—Weekly Treatments.

Date of Bunching.	Nicodust.	Nicodust Precipitated Sulphur.	Precipitated Sulphur.	Check.
Pre—10 December	1·33 (9)	1·5 (16)	1·5 (16)	2·24 (25)
10 December	1·16 (6)	2·0 (9)	2·0 (6)	2·0 (5)
16 December	1·125 (8)	1·9 (8)	2·5 (6)	2·0 (5)
22 December	1·2 (5)	1·4 (7)	1·8 (5)	2·0 (9)
30 December	1·22 (9)	1·3 (7)	1·78 (9)	2·0 (8)
4 January	1·5 (8)	1·44 (9)	2·4 (10)	2·17 (7)
11 January	2·0 (2)	2·1 (7)	2·7 (7)	3·0 (12)
18 January	2·7 (10)	2·0 (3)	3·3 (3)	4·0 (2)
24 January	3·0 (4)	3·3 (3)	3·0 (2)	4·0 (5)
2 February	2·0 (1)	2·5 (2)	3·0 (1)	3·0 (2)
8 February	2·0 (1)	2·5 (2)	2·0 (2)	3·0 (2)
15 February	2·0 (2)	2·0 (2)	..	2·0 (1)

Values according to the scheme—A, 1; B, 2; C, 3; D, 4.

Numbers in brackets indicate the bunches thrown on the date cited and used in estimating the assigned value.

Block I.—Nicodust.

Date of Bunching.	Row 4.				Row 5.				Row 11.				Row 14.				Aggregates.			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Pre—10 December ..	–	1	–	–	1	1	–	–	3	1	–	–	2	1	–	–	6	4	–	–
10 December ..	1	–	–	–	–	–	–	–	2	–	–	–	2	1	–	–	5	1	–	–
16 December ..	1	–	–	–	4	–	–	–	–	–	–	–	2	1	–	–	7	1	–	–
22 December ..	–	–	–	–	1	–	–	–	2	1	–	–	1	–	–	–	4	1	–	–
30 December ..	3	1	–	–	1	–	–	–	1	1	–	–	2	–	–	–	7	2	–	–
4 January ..	4	2	–	–	–	1	–	–	–	1	–	–	–	–	–	–	4	4	–	–
11 January ..	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	2	–	–
18 January ..	–	1	–	–	–	3	4	1	–	–	1	–	–	–	–	–	–	4	5	1
24 January ..	–	–	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	–
2 February ..	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–	–
8 February ..	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–
15 February ..	–	1	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	2	–	–
																	33	23	9	1

Assigned values—A, 1; B, 2; C, 3; D, 4. Total rust incidence, 110; number of bunches, 66 rust incidence per bunch, 1·7.

Block I.—Nicodust and Precipitated Sulphur, 2 : 1.

Date of Bunching.	Row 3.				Row 6.				Row 10.				Row 15.				Aggregates.			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Pre—10 December ..	1	2	–	–	2	–	–	–	2	2	1	–	4	2	–	–	9	6	1	–
10 December ..	1	–	–	–	–	2	–	–	–	2	–	–	–	3	1	–	1	7	1	–
16 December ..	–	–	–	–	1	1	–	–	–	2	–	–	–	4	–	–	1	7	–	–
22 December ..	2	–	–	–	1	–	–	–	1	3	–	–	–	–	–	–	4	3	–	–
30 December ..	–	1	–	–	1	–	–	–	4	1	–	–	–	–	–	–	5	2	–	–
4 January ..	3	3	–	–	1	–	–	–	1	–	–	–	–	1	–	–	5	4	–	–
11 January ..	–	3	–	–	–	1	1	–	–	1	–	–	–	1	–	–	–	6	1	–
18 January ..	–	1	1	–	–	–	–	–	–	–	1	–	–	–	–	–	–	1	2	–
24 January ..	–	–	–	–	–	–	–	2	–	1	–	–	–	–	–	–	–	1	–	2
2 February ..	1	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1	–	–	1
8 February ..	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	–	1	1	–
15 February ..	1	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1	–	1	–
																	27	38	7	3

Assigned values—A, 1; B, 2; C, 3; D, 4. Total rust incidence, 136; number of bunches, 75; rust incidence per bunch, 1·8.

Block I.—Precipitated Sulphur.

Date of Bunching.	Row 1.				Row 8.				Row 12.				Row 13.				Aggregates.			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Pre—10 December ..	–	–	–	–	2	3	–	–	4	4	–	–	2	1	–	–	8	8	–	–
10 December ..	–	1	–	–	–	–	–	–	–	3	–	–	–	2	–	–	–	6	–	–
16 December ..	–	1	–	–	–	1	1	–	–	–	–	–	–	1	2	–	–	3	3	–
22 December ..	–	–	–	–	1	1	–	–	–	3	–	–	–	–	–	–	1	4	–	–
30 December ..	–	2	–	–	–	2	–	–	–	2	–	–	1	2	–	–	1	8	–	–
4 January ..	–	3	1	–	–	2	1	–	–	1	2	–	–	–	–	–	–	6	4	–
11 January ..	–	2	1	–	–	–	1	–	–	–	–	–	–	–	3	–	–	2	5	–
18 January ..	–	–	1	1	–	–	1	–	–	–	–	–	–	–	–	–	–	–	2	1
24 January ..	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–
2 February ..	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–
8 February ..	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–
																	11	37	18	1

Assigned values—A, 1; B, 2; C, 3; D, 4. Total rust incidence, 143, number of bunches, 67; rust incidence per bunch, 2·1.

Block I.—Check Rows.

Date of Bunching.	Row 2.				Row 7.				Row 9.				Row 16.				Aggregates.			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Pre—10 December ..	–	1	1	–	2	4	2	–	–	4	2	1	2	4	1	1	4	13	6	2
10 December ..	–	–	–	–	–	3	–	–	–	1	–	–	–	1	–	–	–	5	–	–
16 December ..	–	1	1	–	–	–	1	–	–	2	–	–	–	–	–	–	–	3	2	–
22 December ..	–	2	1	–	–	2	1	–	–	3	–	–	–	–	–	–	–	7	2	–
30 December ..	–	4	–	–	–	–	–	–	–	1	–	–	–	3	–	–	–	8	–	–
4 January ..	–	1	1	–	–	1	1	–	–	1	–	–	–	2	–	–	–	5	2	–
11 January ..	–	1	–	–	–	–	2	1	–	–	1	1	–	1	5	–	–	2	8	2
18 January ..	–	–	–	–	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	2
24 January ..	–	–	3	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	3	2
2 February ..	–	–	–	1	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	1
8 February ..	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	–	–	2	–
15 February ..	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–	–
																	4	44	26	9

Assigned values—A, 1; B, 2; C, 3; D, 4. Total rust incidence, 206; Number of bunches, 83; rust incidence per bunch, 2·5.

Block II.—Fortnightly Treatments.

Date of Bunching.	Nicodust.	Nicodust Precipitated Sulphur.	Precipitated Sulphur.	Check.
Pre—10 December	2·6 (39)	2·4 (36)	2·7 (38)	1·9 (32)
10 December	2·0 (6)	1·9 (16)	2·2 (18)	1·9 (15)
16 December	2·0 (4)	1·75 (4)	2·0 (4)	1·9 (8)
22 December	1·5 (8)	1·5 (2)	1·7 (7)	1·9 (7)
30 December	1·7 (10)	1·5 (13)	1·6 (10)	1·5 (8)
4 January	1·6 (7)	2·0 (10)	1·9 (9)	2·0 (7)
11 January	2·3 (6)	2·5 (4)	2·3 (7)	2·5 (2)
18 January	2·0 (2)	4·0 (1)	3·0 (5)	2·5 (2)
24 January	3·0 (5)	3·3 (3)	3·4 (5)	3·5 (2)
2 February	2·5 (2)	3·5 (2)	..	4·0 (3)
8 February	..	1·75 (4)	3·0 (1)	..

Values according to the scheme—A, 1; B, 2; C, 3; D, 4.

The numbers in brackets indicate the bunches thrown on the date cited and used in estimating the assigned value.

Block II.—Nicodust.

Date of Bunching.	Row 2.				Row 6.				Row 12.				Aggregates.			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Pre—10 December	1	4	1	1	1	10	3	7	–	5	4	2	2	19	8	10
10 December	3	–	–	1	–	–	–	1	1	–	–	–	4	–	–	2
16 December	1	–	–	–	–	1	–	–	–	1	1	–	1	2	1	–
22 December	1	3	–	–	3	–	–	–	1	–	–	–	5	3	–	–
30 December	1	1	–	–	–	–	–	–	2	6	–	–	3	7	–	–
4 January	2	–	–	–	1	2	–	–	–	2	–	–	3	4	–	–
11 January	–	3	–	–	–	–	–	–	–	1	2	–	–	4	2	–
18 January	–	–	–	–	–	–	–	–	1	–	1	–	1	–	1	–
24 January	–	–	3	–	–	1	–	1	–	–	–	–	–	1	3	1
2 February	–	–	–	–	–	–	1	–	–	1	–	–	–	1	1	–
													19	41	16	13

Assigned values—A, 1; B, 2; C, 3; D, 4. Total rust incidence, 201; number of bunches, 89; rust incidence per bunch, 2·3.

Block II.—Nicodust and Precipitated Sulphur, 2 : 1.

Date of Bunching.	Row 1.				Row 8.				Row 10.				Aggregates.			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Pre—10 December	–	8	7	–	1	10	2	2	–	1	4	1	1	19	13	3
10 December	1	2	–	–	3	3	–	–	–	5	2	–	4	10	2	–
16 December	1	–	–	–	–	2	–	–	–	1	–	–	1	3	–	–
22 December	1	–	–	–	–	–	–	–	–	1	–	–	1	1	–	–
30 December	3	2	–	–	2	2	–	–	2	2	–	–	7	6	–	–
4 January	–	4	–	–	1	4	–	–	–	–	1	–	1	8	1	–
11 January	–	–	2	–	–	2	–	–	–	–	–	–	–	2	2	–
18 January	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1
24 January	–	–	–	–	–	–	–	–	–	1	1	1	–	1	1	1
2 February	–	–	–	1	–	–	1	–	–	–	–	–	–	–	1	1
8 February	–	–	–	–	–	–	–	–	1	3	–	–	1	3	–	–
													16	53	20	6

Assigned values—A, 1; B, 2; C, 3; D, 4. Total rust incidence, 206; number of bunches, 95; rust incidence per bunch, 2·2.

Block II.—Precipitated Sulphur.

Date of Bunching.	Row 4.				Row 5.				Row 11.				Aggregates.			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Pre—10 December	1	9	6	2	–	4	3	4	1	2	3	3	2	15	12	9
10 December	–	8	2	1	–	3	–	–	1	3	–	–	1	14	2	1
16 December	–	1	–	–	–	2	–	–	–	1	–	–	–	4	–	–
22 December	–	3	–	–	2	1	–	–	1	1	–	–	3	5	–	–
30 December	–	1	–	–	–	3	–	–	4	2	–	–	4	6	–	–
4 January	1	2	–	–	1	1	1	–	–	3	–	–	2	6	1	–
11 January	1	1	2	–	–	1	1	–	–	1	–	–	1	3	3	–
18 January	–	–	–	–	–	1	1	1	–	–	2	–	–	1	3	1
24 January	–	–	1	–	–	–	2	1	–	–	–	1	–	–	3	2
2 February	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
8 February	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–
													13	54	25	13

Assigned values—A, 1; B, 2; C, 3; D, 4. Total rust incidence, 248; number of bunches, 104; rust incidence per bunch, 2·4.

Block II.—Check Rows.

Date of Bunching.	Row 3.				Row 7.				Row 9.				Aggregates.			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Pre—10 December	–	4	2	–	2	9	3	–	1	6	4	1	3	19	9	1
10 December	1	5	1	–	1	3	–	–	1	2	1	–	3	10	2	–
16 December	1	2	–	–	–	3	–	–	–	2	–	–	1	7	–	–
22 December	2	1	–	–	–	1	–	–	–	3	–	–	2	5	–	–
30 December	1	1	–	–	2	3	–	–	1	–	–	–	4	4	–	–
4 January	–	3	–	–	–	3	–	–	–	1	–	–	–	7	–	–
11 January	–	1	–	–	–	–	1	–	–	–	–	–	–	1	1	–
18 January	–	1	–	–	–	–	1	–	–	–	–	–	–	1	1	–
24 January	–	–	–	–	–	–	–	–	–	–	1	1	–	–	1	1
2 February	–	–	–	1	–	–	–	–	–	–	–	2	–	–	–	3
													13	54	14	5

Assigned values—A, 1; B, 2; C, 3; D, 4. Total rust incidence, 183; number of bunches, 86; rust incidence per bunch, 2·1.

APPENDIX IV.

MODIFICATIONS OF THE DUSTING APPARATUS.

The dusting of the banana bunch presents problems quite different from those associated with the treatment of other crops. With the banana bunch the object to be dusted is at or about chest level, and the dust must be applied from all sides if the various faces of the bunch are to be covered. The operator himself cannot very well move round the bunch, and has therefore to project the dust towards himself when treating the fruit furthest away from him. This is practicable with small plunge dusters, but these, though perhaps suitable for small areas where time and convenience are of small moment, are quite inadequate for general plantation use. Large rotary dusters provide very satisfactory motive power, but most makes on the market have a rigid arm made up of sectional tubes which fit into one another. Some have a semi-flexible feed arm, but the construction is heavy.

For the banana bunch treatment, the duster requires adequate motive power and a feed arm which can be readily manipulated by the operator. In the rotary duster available, the feed arm consisted of three sections fitting into one another. The first two of these were dispensed with in the modification, and a specially prepared flexible tube made of duck and supported by a spiral steel wire was substituted. The length of the flexible tube was kept at a minimum—in practice some 15-18 inches.

The procedure is simple. Either 12 or 14 gauge steel wire is carefully twisted round an inch bar carried on the frame of a lathe in such a way that neighbouring coils touch each other. When a coil of some 8 inches is wrapped round the bar, it is liberated with the greatest possible care. When relaxed the steel wire cylindrical spring has a diameter of 1¾ inches. The ends of the spring are pulled apart until adjacent coils are ¾ inch apart, and trimmed to a length of 15-18 inches. A sleeve is made to fit the spring, heavy duck or some similar material sufficiently strong to stand the strain of constant use in the plantation being suitable. The free ends are then clamped in position, one to the hopper of the duster, the other to the last section of the rigid feed arm, this and the fishtail feed being retained in the modified apparatus.

In operation, the rigid section is held in the left hand, and can be manipulated at will, the dust charge being applied to the various parts of the bunch with the minimum inconvenience.

SEASONAL GREETINGS ACKNOWLEDGED.

Seasonal greetings have been received by the "Queensland Agricultural Journal" from the "Courier-Mail," Brisbane; "The Producers' Review," Toowoomba; "The Fruit Culture," Agricultural Press, Ltd., Sydney; State Service Union; F. M. J. Baker, M.P.; Australian Broadcasting Commission; "Rosewood Register"; "Monto Herald"; Queensland Forestry Department; St. Joseph's College, Nudgee; Queensland Co-operative Bacon Association, Ltd., Murarrie; and numerous readers in different parts of Queensland and in other States of the Commonwealth and Mandated Territories. All greetings are warmly acknowledged and cordially reciprocated.

Australian and European Bacon.

By E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

WITH a view to affording pig raisers and trade representatives in Queensland opportunity of making a detailed comparison of the commercial quality of Australian and European bacon, the Royal National Agricultural Association of Queensland, at the recent Brisbane Exhibition, staged a display of bacon sides, such as find ready sale on the markets of the United Kingdom, where bacon and other pork products from European countries vie with home-grown products and those of the dominions for first place in the trade.

The illustrations show the sides as they were on view at the pig section of the exhibition. Following are the weights from London, as supplied by the Farmers' Co-operative Distributing Association, Limited, Brisbane, who imported the sides on behalf of the Royal National Association. The sides were smoked at Murarrie:—

WEIGHT OF SIDES FROM LONDON.

Origin.	London Invoice Weights.	Weights when Unpacked.	Smoked Weights.
	Lb.	Lb.	Lb.
Ireland	53	50½	49
Sweden	58	54½	52½
Canada	46	43	40
Poland	56	51	49
Denmark	60	55	53
Holland	59	54½	53

The Queensland sides averaged 45 lb. smoked weights.

All the sides received similar treatment in the final stages of preparation. After being cured, the imported sides were dispatched in a frozen condition, referred to in the trade as green or unsmoked bacon—i.e., bacon that has been salted and cured, but not finally washed, dried, smoked, polished, and prepared for market.

The imported sides were thereafter subjected to these processes at the Murarrie Bacon Factory, and were finally delivered at the Exhibition, along with typical Queensland sides kindly lent for the purpose by Foggitt, Jones, Proprietary, Limited, J. C. Hutton Proprietary, Limited, and the Queensland Co-operative Bacon Association, Limited, of Brisbane.

An endeavour was made to display Queensland sides of similar weight, conformation, and condition so that a fair comparison could be made, and these are illustrated along with Irish and Canadian sides—Australia's keenest Empire competitors on the markets of the old world—Swedish, Dutch, Polish, and Danish sides of average commercial quality are also illustrated. To enable a further and more minute examination to be made, the sides were cut and the cut portion of one of each of the flitches is shown.

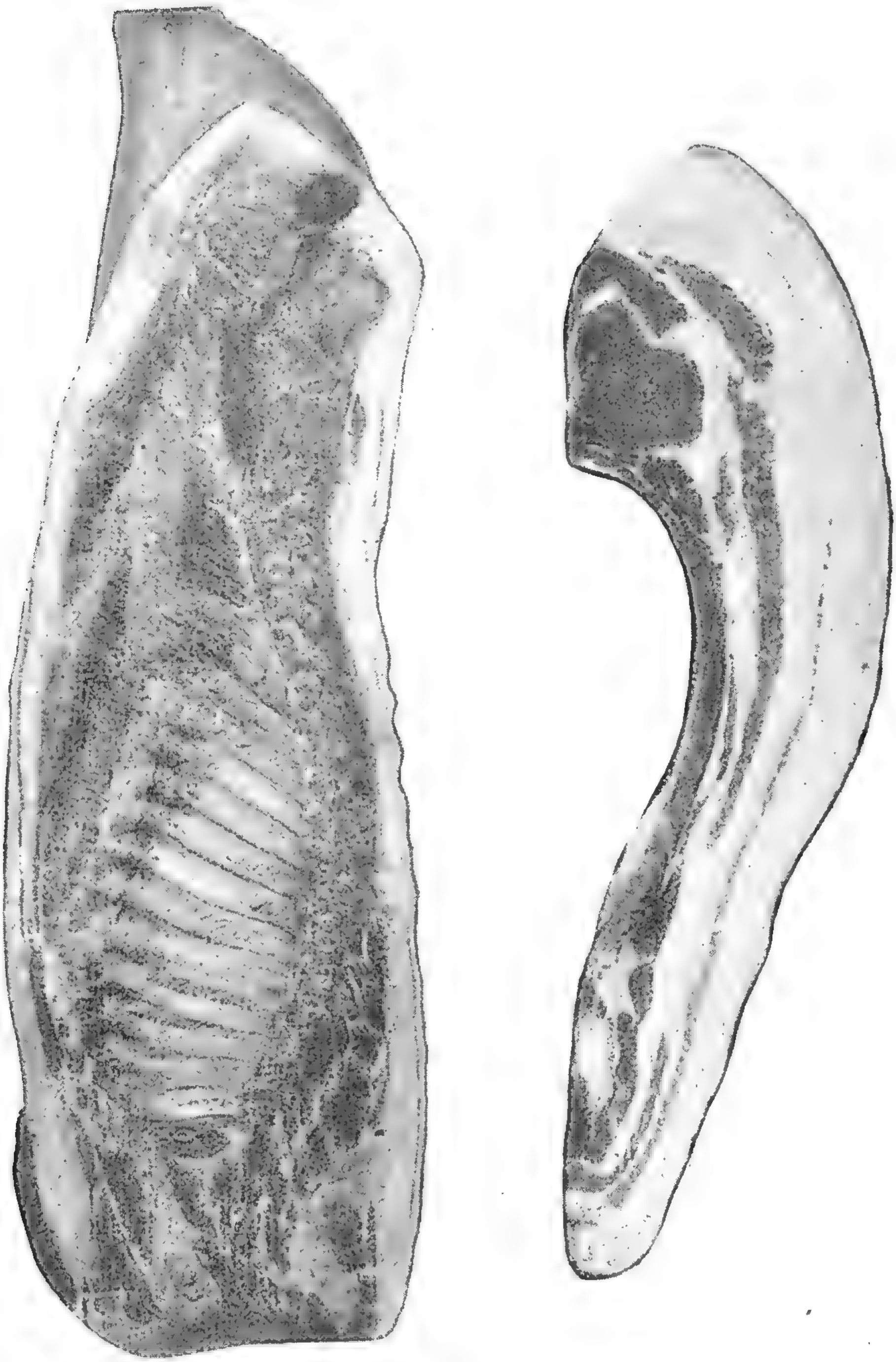

PLATE 4.—QUEENSLAND BACON.

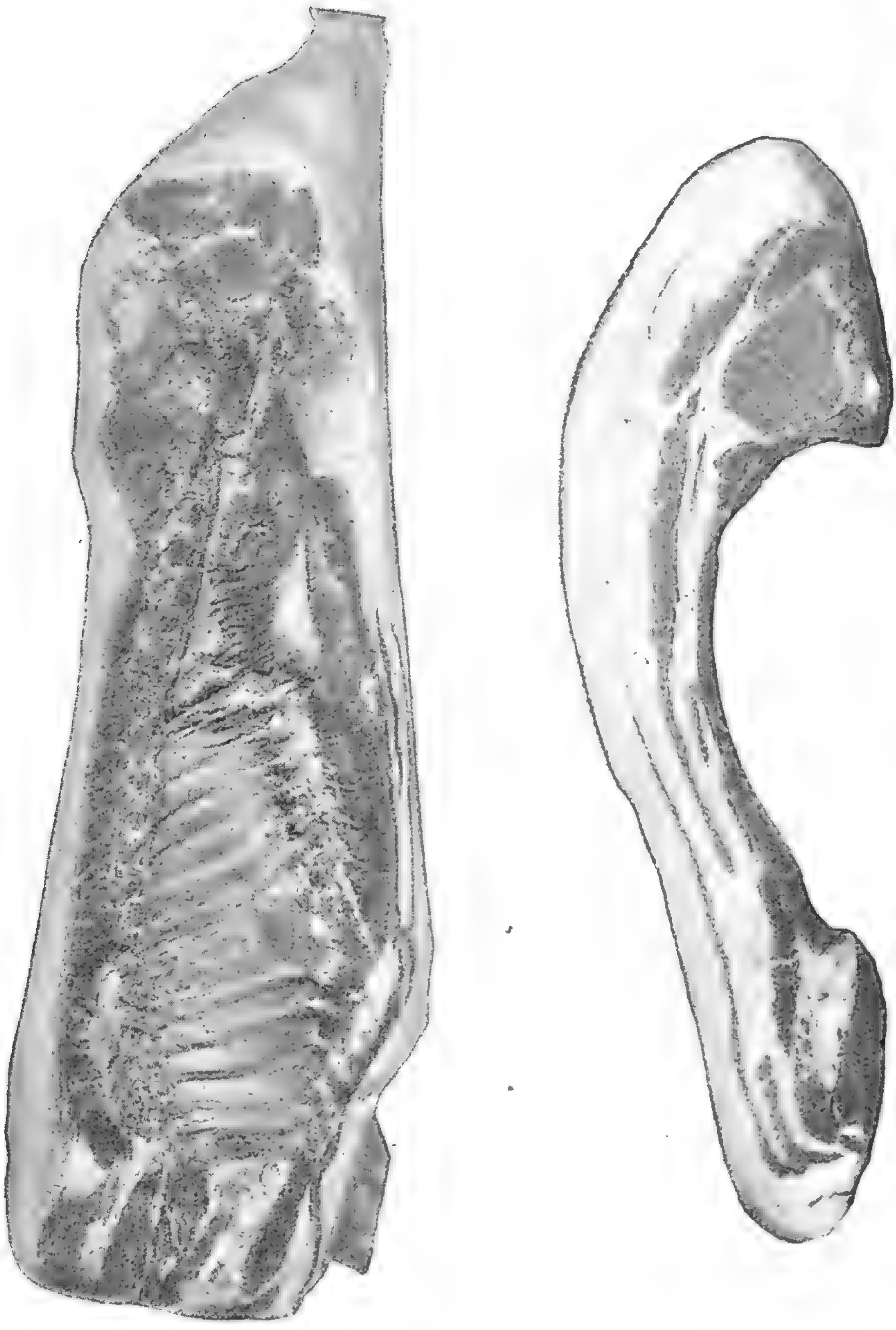

PLATE 5.—QUEENSLAND BACON.

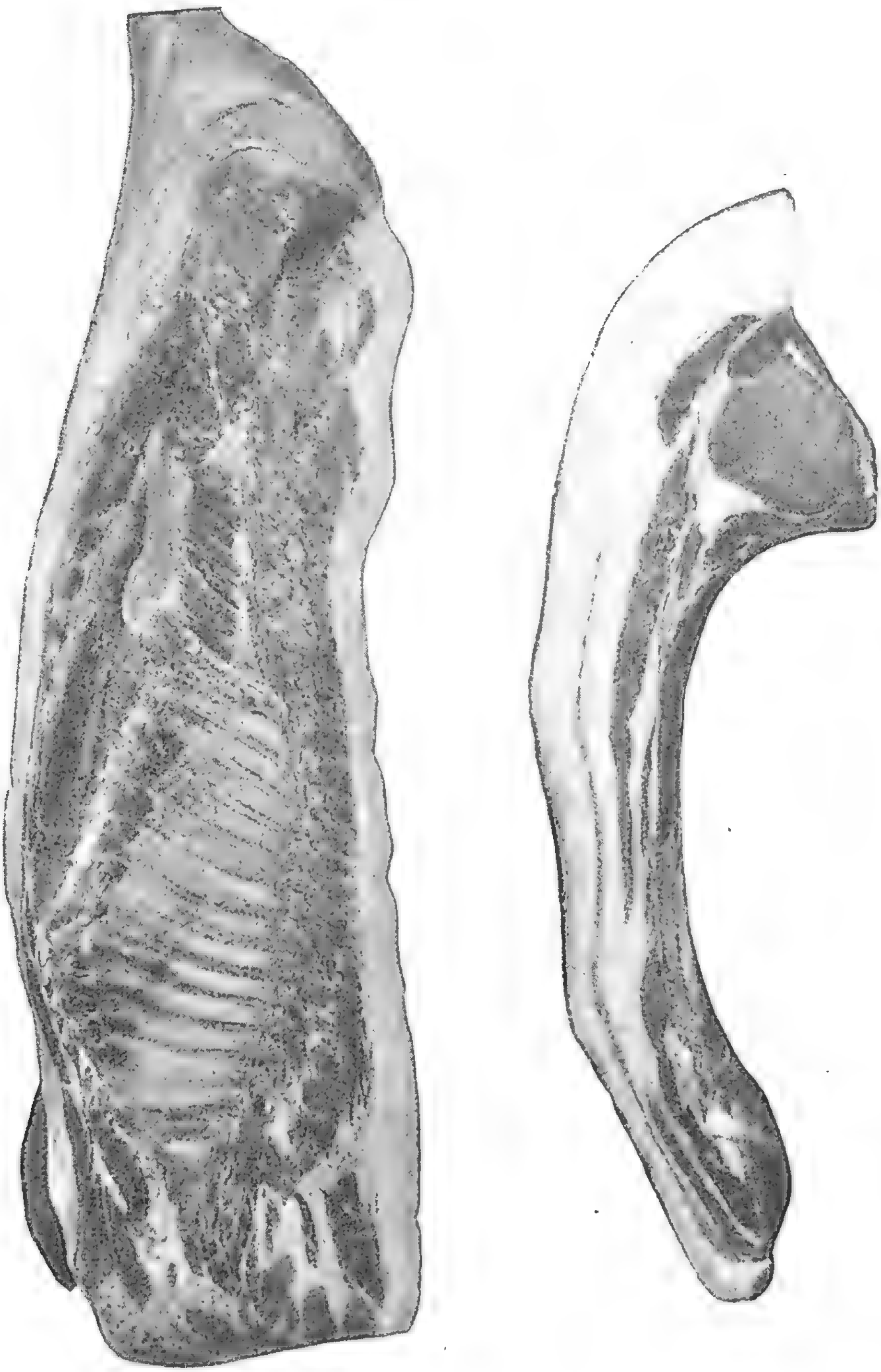

PLATE 6.—QUEENSLAND BACON.

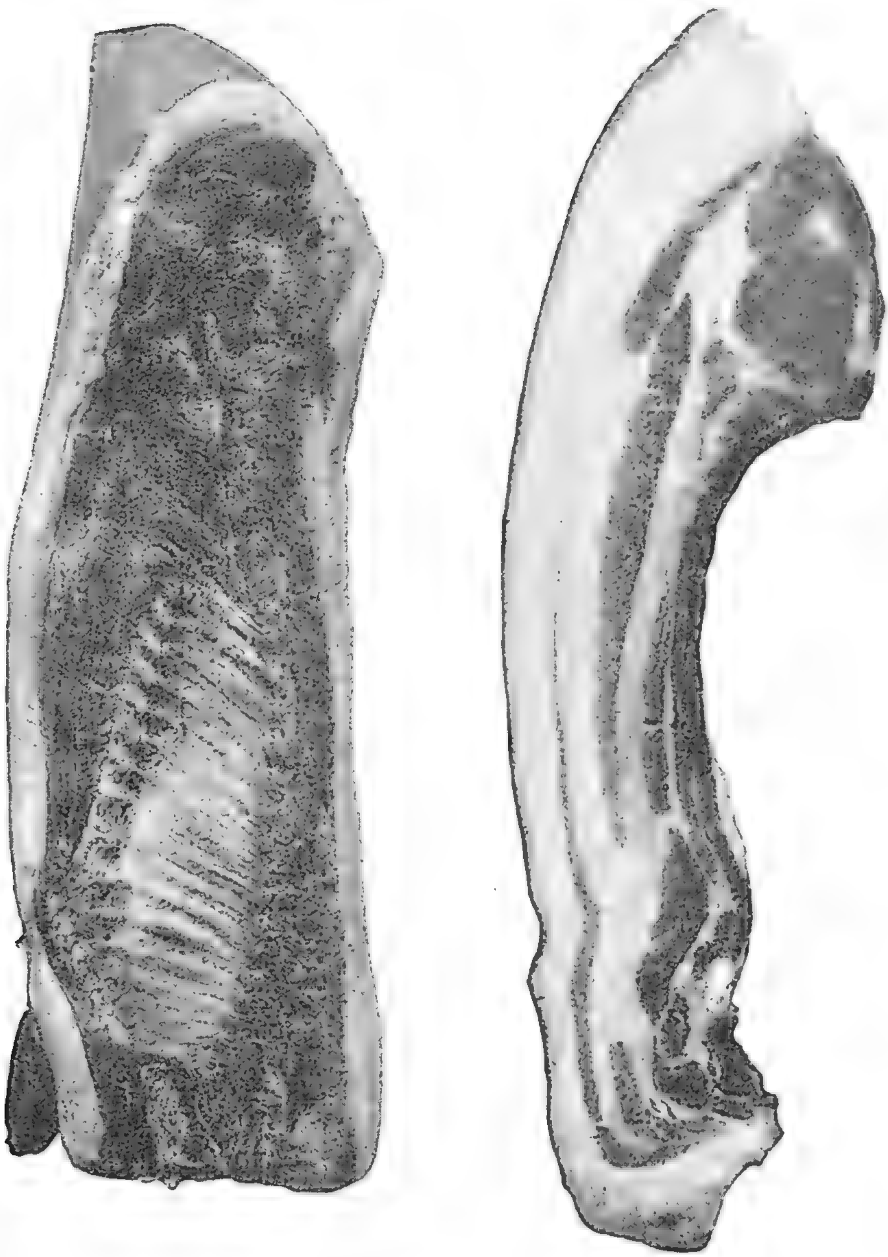

PLATE 7.—DANISH BACON.

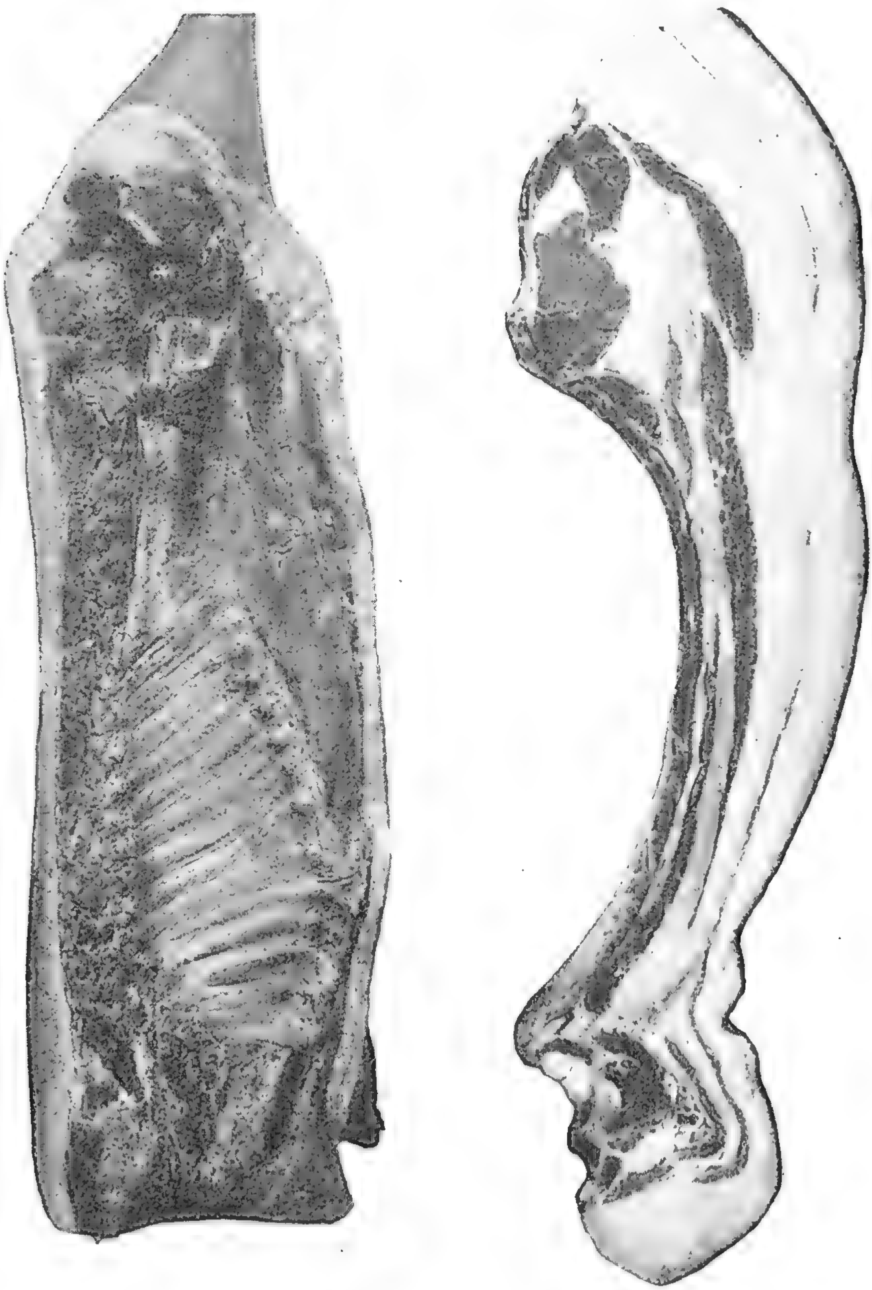

PLATE 8.—POLISH BACON.

Advices received from Great Britain in connection with consignment indicated that it was not possible to obtain bacon sides of Argentine or United States of America manufacture, as those countries are no longer sending Wiltshire long sides to Britain; nor was it possible to obtain Latvian sides, as they were not represented on the Smithfield markets.

Comment.

It was ascertained that, in regard to the Polish bacon, the feeds used in the production of the bacon sides shown included potatoes, barley, rye, and dairy products and, in smaller quantities, household refuse—all suitable for use in rations for the production of bacon pigs. In Poland, maize is used only in exceptional cases, and then exclusively in the southern districts of that country. The curing process for Polish bacon is strictly in accordance with requirements of the British Ministry of Agriculture and Fisheries. Polish pigs consist almost entirely of three groups—Landrace, improved pigs, and purebred pigs—the production of which depends on the import of stud stock from England and Germany according to breeds. The good points of the Polish Landrace is their resistance to unfavourable conditions and great fertility. As for pedigree pigs used in Poland, first place is occupied by the British Large White, and next by the German White Pointed Ear Pig (Deutsches Edelschwein). There are not many Berkshires, Large Blacks, or Westphalian pigs.

Danish Pigs.

The characteristic feature of the production of pork in Denmark is the close association of pig breeding with dairy farming. The various by-products of the dairy—skimmed milk, butter milk, and whey—are used in the feeding of pigs to the utmost extent possible, and milk is so far recognised as a basic food for pigs that its use is almost entirely regarded as obligatory. Practically all Danish farmers use cereals and milk as the sole food of the young animals. If grain prices are high, part of the cereals may be replaced by such feeds as potatoes, sugar beet, swedes, &c., but this is usually of advantage to the quality of the pork, a moderate quantity of root crops having a favourable effect on the fattening. Unduly large quantities of sugar beets and swedes may have the effect that the flesh acquires an unfavourable (soft) consistence, but as this feeding is quite uneconomical, and as the pigs are paid for according to the quality of the pork, the risk of an exaggerated use of these foodstuffs really does not arise in actual practice.

Denmark uses principally the Large White Yorkshire breed crossed with the native Landrace.

Swedish Pigs.

In Sweden pig feeding is carried on for the most part on small farms and decreases regularly with increased acreage. Next to butter, bacon is the most important article of Swedish exports in animal products. The little pigs are first supplied with other food while still suckling. For this purpose they are admitted to a smaller sty at the side of that of their dam, where they are given whole barley or rye, and later on warm fresh skim milk in small quantities. At the age of from six to seven weeks of age, the pigs are weaned. During the first weeks of transition (i.e., after weaning) fresh lukewarm cow's milk is substituted for the sow's milk. Considerable attention is paid to the cleaning of the

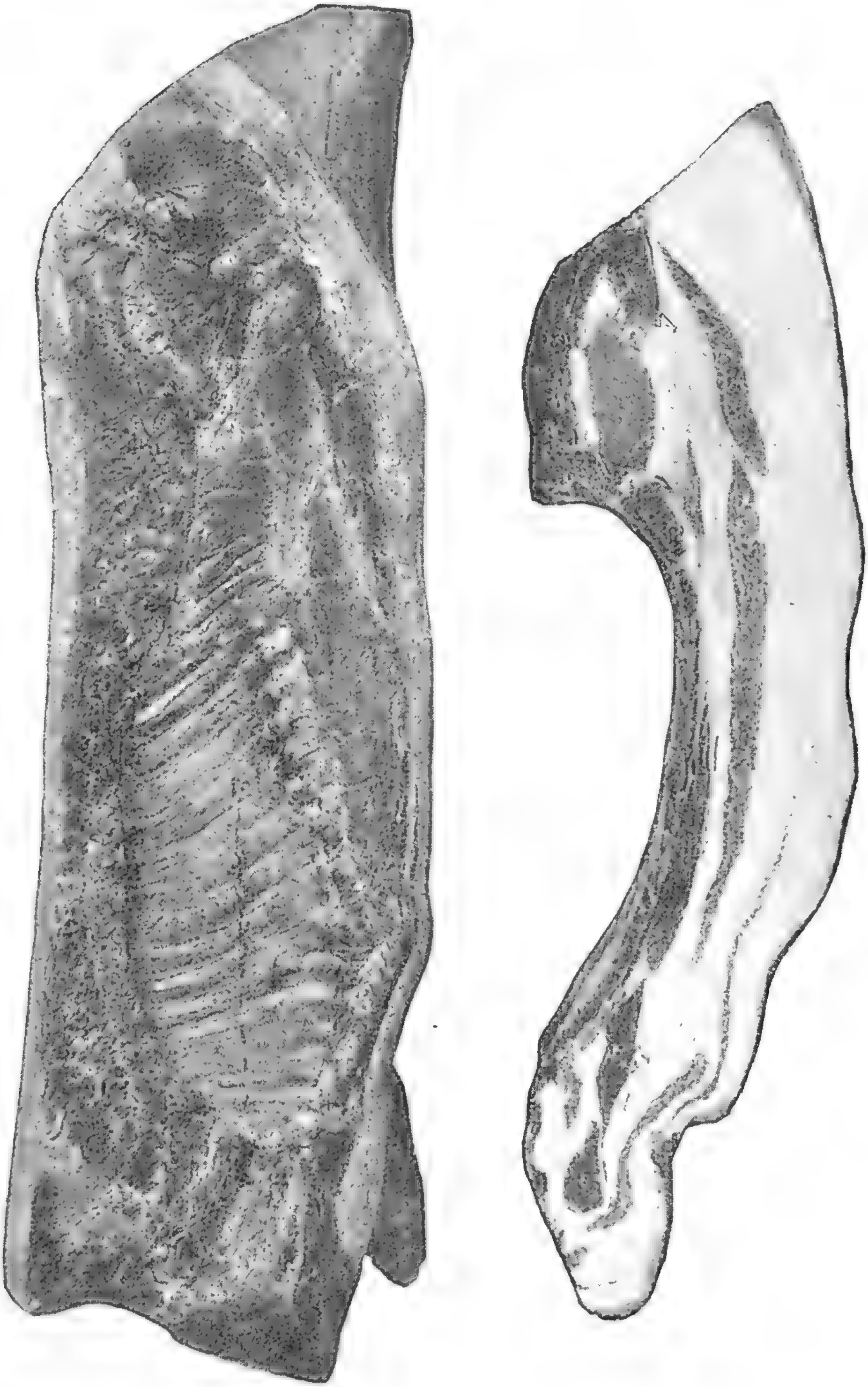

PLATE 9.—IRISH BACON.

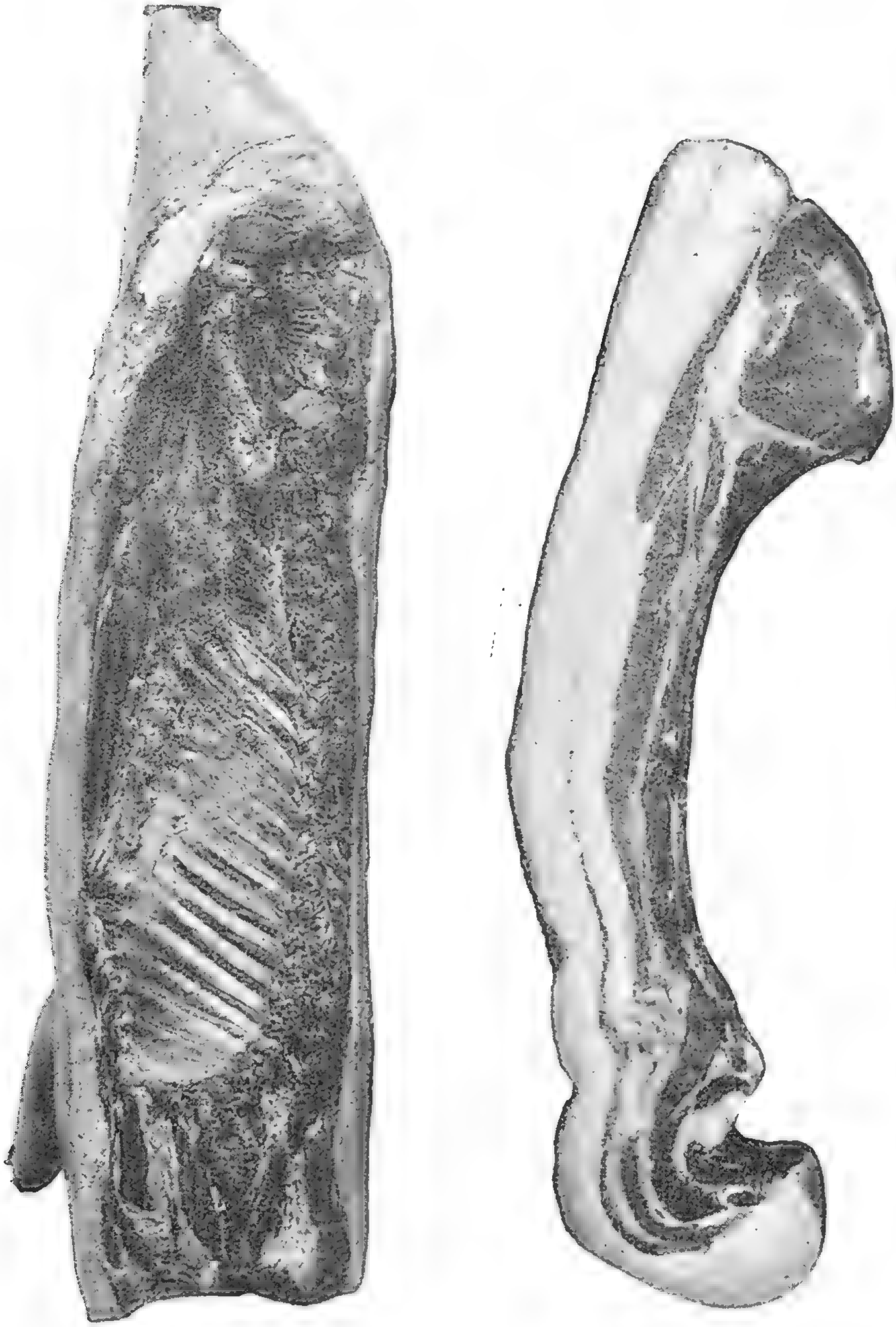

PLATE 10.—SWEDISH BACON.

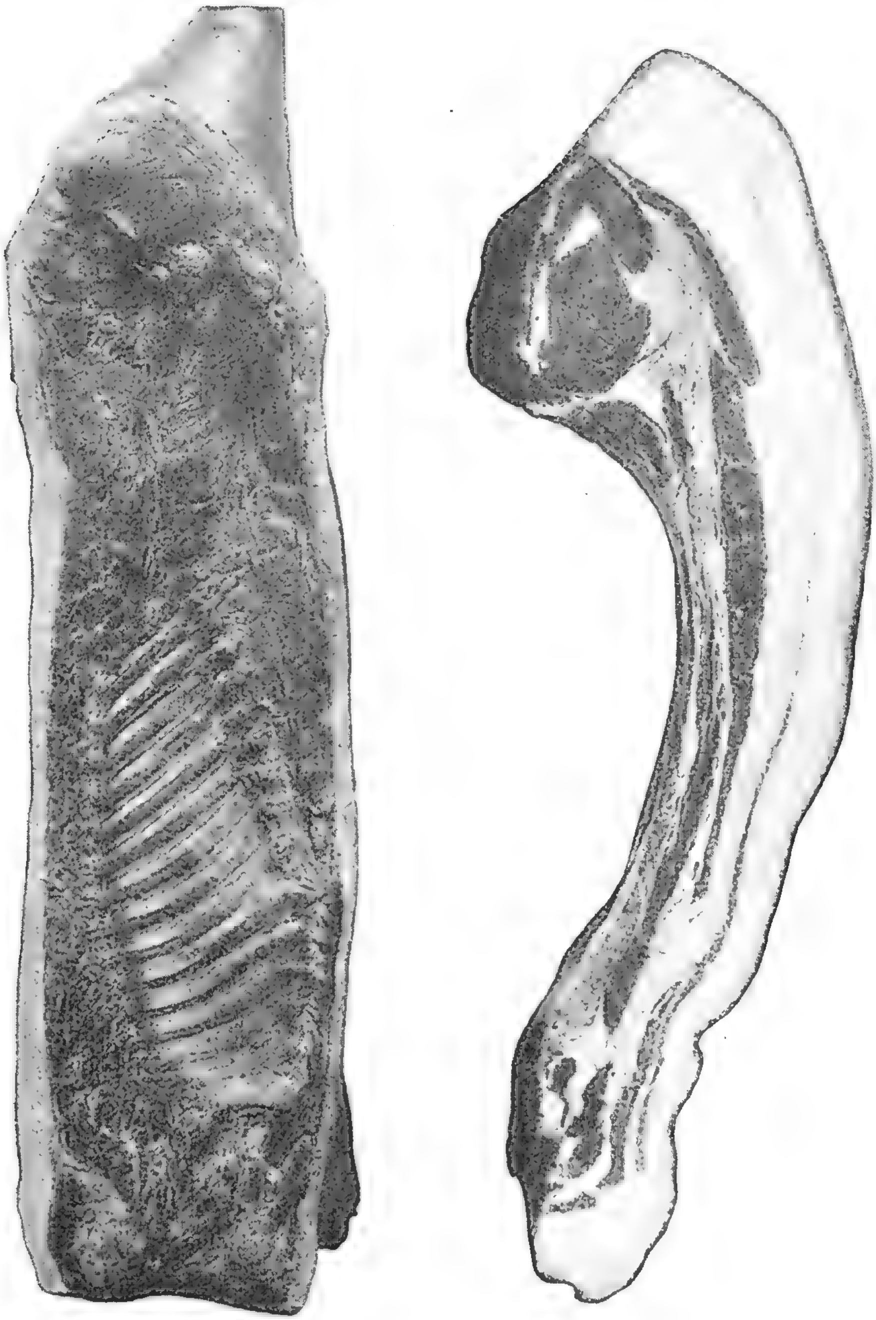

PLATE 11.—DUTCH BACON.

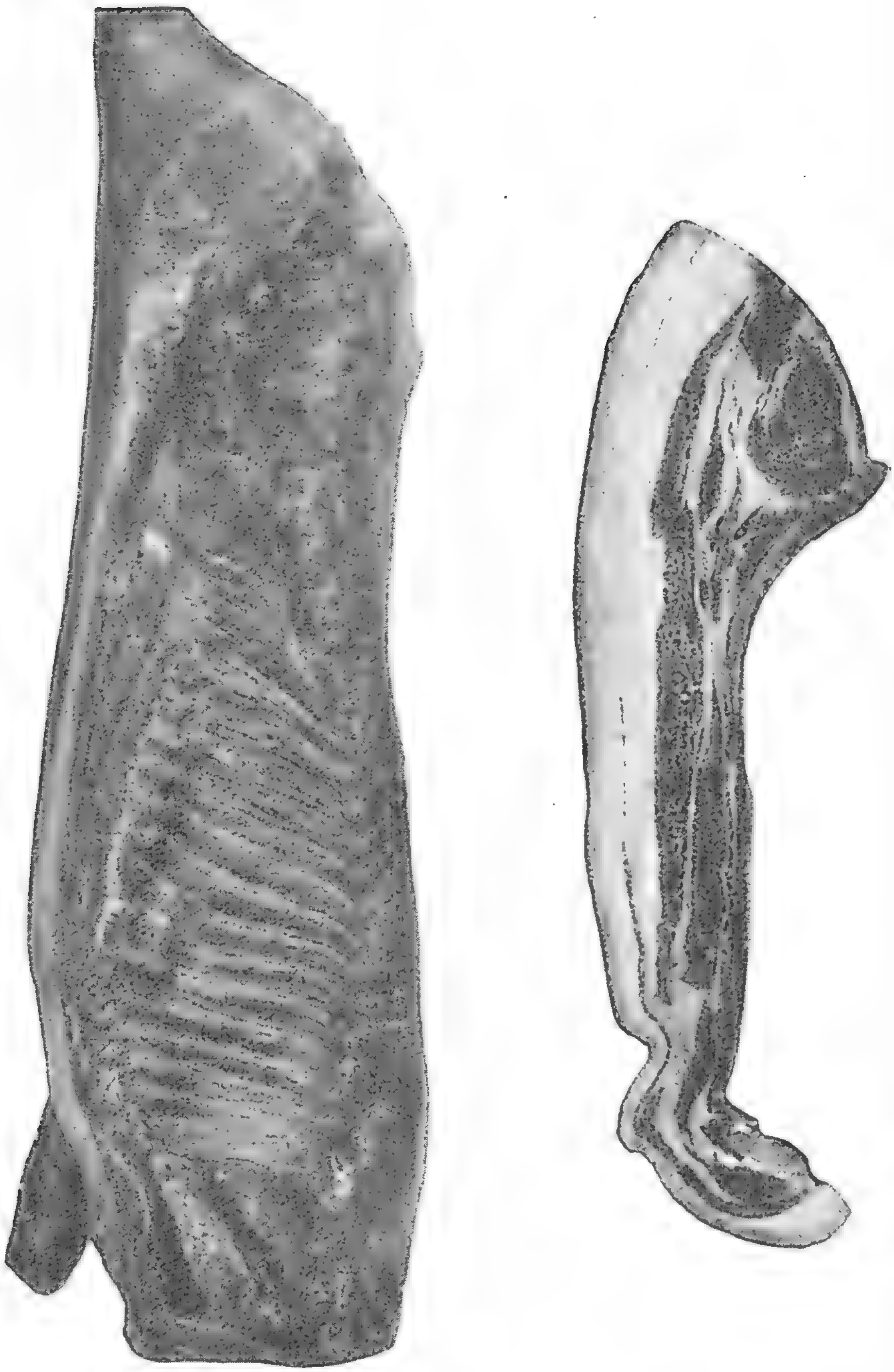

PLATE 12.—CANADIAN BACON.

troughs in order to avoid souring the food. Having reached the age of eight to ten weeks, the little pigs receive crushed or ground corn instead of whole cereals. In addition, roots or boiled potatoes often form a part of the rations. The feeding of breeding animals is given special attention.

The most prominent of the breeds used is the Large White Yorkshire, the prevailing breed in Sweden now. These and the Swedish Landrace are crossed together with excellent results. The general pig industry of the country has been largely influenced during the last decade by breeding animals emanating from breeding stations for the Large White. In this way, by means of pure breeding and very frequent cross-breeding, the Large White has influenced to a larger degree the present stock of the country. The Swedish Landrace has been developed on exactly the same lines as the Danish Landrace, with which it is closely related.

In the Netherlands.

Similar conditions prevail in the Netherlands and Holland where the Netherlands Bacon Control Office exercises a considerable influence on pig raisers.

In Canada.

Canadian Hog Grading Regulations have also largely influenced the breeding of pigs in Canada. The use of home-grown grains is recommended for the production of select bacon pigs, especially as export and domestic markets demand the production of the select bacon and bacon grades of pigs. The premium of one dollar per pig for select bacon pigs is an additional substantial profit, encouraging the farmer to produce and market the best stock possible.

In Ireland.

As is well known, some of the best pigs in the world are produced in Ireland. Irish bacon has an excellent reputation on the markets of the United Kingdom. There nothing is too good for the pig. This is in striking contrast with the keeping of pigs under rough and unhygienic conditions conducive to disease, slow growth, and no profit. In Ireland, also, the white breeds are very popular, the Large and Middle Whites being largely used on stock of local production. Milk, barley, and potatoes are foods in everyday use, while the strictest attention is given to systems of feeding and management.

COMMENT ON BACON EXHIBITED.

Points to be Noted.

It will be noted that some of the sides exhibited are of greater length than others; a closer examination will reveal that this increased length is due to an increased number of ribs. As a result of observation of a large number of pig carcasses, Professor A. M. Shaw, a noted American scientist, has shown that there is considerable variation in the number of pairs of ribs in pigs. The normal number is fourteen pairs. In some of the sides illustrated, sixteen ribs are present. Professor Shaw has observed 3,957 animals, with the following results:—20 animals had thirteen pairs of ribs each, 1,574 had fourteen pairs each, 1,829 had fifteen pairs each, 310 had sixteen pairs, and 7 had seventeen

pairs each. The remainder showed uneven pairs or floating ribs. No normal litters were found where all the pigs possessed the same rib numbers.

It is possible there is room for much research work in connection with the length of side of the pig. It might be noted that in the butchering of the sides for bacon curing, the first pair of ribs—one on each side—is invariably removed, this being a recognised practice in the trade.

It will be noted further that all sides show a reasonable uniformity in width. All the imported sides have the aitch bone removed exposing the knuckle joint in the ham. They also have the shoulder blades removed, as is required in the Wiltshire long side trade. The Queensland sides have not been dealt with in this way, as neither aitch bone nor shoulder blade is removed in curing bacon in this country.

All the sides except the Canadian carry a similar proportion of back fat, the Canadian was considered by most of those qualified to speak as being altogether too thin for best trade requirements. Actually, it cut out equal to the best, a point not to be overlooked now that the demand is for a long, lean side with a minimum of fat. Possibly it was for this reason that the Canadian side darkened more in the smoking process than the other sides. The Irish side was definitely too fat, even for the best English trade. The European sides were all typical, Swedish and Dutch sides being superior to the Polish and Danish.

The Queensland sides were very satisfactory, and on the whole made an excellent showing. Unfortunately, however, we have no record of the breed or cross represented by these sides.

The display generally was highly educational, and emphasised the importance of extension work in learning exactly what overseas markets require.

Queensland representatives who examined the sides felt that, while there is considerable room for improvement here, we are on the right lines, and now that a definite move has been made to prepare for an extensive overseas trade, such questions as length and leanness of side, uniformity, freedom from blemish, and production at a cost that will allow of a reasonable margin of profit become all the more important.

If you like this issue of the Journal, kindly bring it under the notice of a neighbour who is not already a subscriber. To the man on the land it is free. All that he is asked to do is to complete the Order Form on another page and send it to the Under Secretary, Department of Agriculture and Stock, together with a shilling postal note, or its value in postage stamps, to cover postage for twelve months.

The House Fly.

By J. A. WEDDELL, Assistant Entomologist.

THE house fly, *Musca domestica* Linn., may be rated amongst the most common insect associates of man, but familiarity with this insect has been accompanied by a corresponding ignorance of and indifference to the dangers to health that are associated with its presence. However, there is now an awakening to this danger the reality of which is indicated by the fact that the names "disease carrier" and "typhoid fly" have been suggested as substitutes for the somewhat innocent-sounding name of "house fly." This article discusses briefly the life-history and habits of the house fly, and points out the various recognised measures which may be adopted for its control.

Distribution.

The house fly is widespread throughout the world; it is present in every continent, and has been found not only in the tropical and temperate zones, but even in subpolar regions such as Lapland and Finland. Not merely is the fly widespread, but, given suitable conditions, it is capable of breeding to enormous local populations.

Life-cycle Stages.

The eggs are tiny white objects, somewhat banana-shaped and about one-twentieth of an inch in length. (Plate 13; fig. 1.)

The larva or maggot (Plate 13; fig. 2) is slender, white, and shining, and is about one-twelfth of an inch long when it hatches. The body thickens from a narrow-pointed head to a blunt and rounded anal segment. When full grown the length has increased to almost half an inch, and the colour gradually changes to a creamy shade. During the growth period the larva moults twice.

The pupal stage of the insect is passed within the final larval skin, which envelopes the insect and contracts and hardens into a cylindrical-shaped puparium with rounded ends. The colour deepens to dark-brown. The puparium is approximately one quarter of an inch in length (Plate 13; fig. 3).

A detailed description of the adult fly is rendered needless both by familiarity and because of the accompanying illustration (Plate 13; fig. 4). It is necessary to refer to only a few structures. The mouth-parts (Plate 13; fig. 5) are wonderfully complex, with a proboscis capable of extrusion for the purpose of sucking liquid food. It is incapable of piercing or chewing, but solid foot such as sugar is first dissolved by a flow of saliva and the resultant solution is then sucked up.

The tarsal joints of the legs constituting the feet are well adapted for walking either vertically or upside down on smooth surfaces. The terminal joint (Plate 13; fig. 6) has, besides two claws, two sticky pads covered with very fine hairs and furnished with glandular openings from which there exudes a sticky fluid.

The legs and body of the fly are clothed in fine hair-like spines which make the lodgment of contaminating particles almost inevitable.

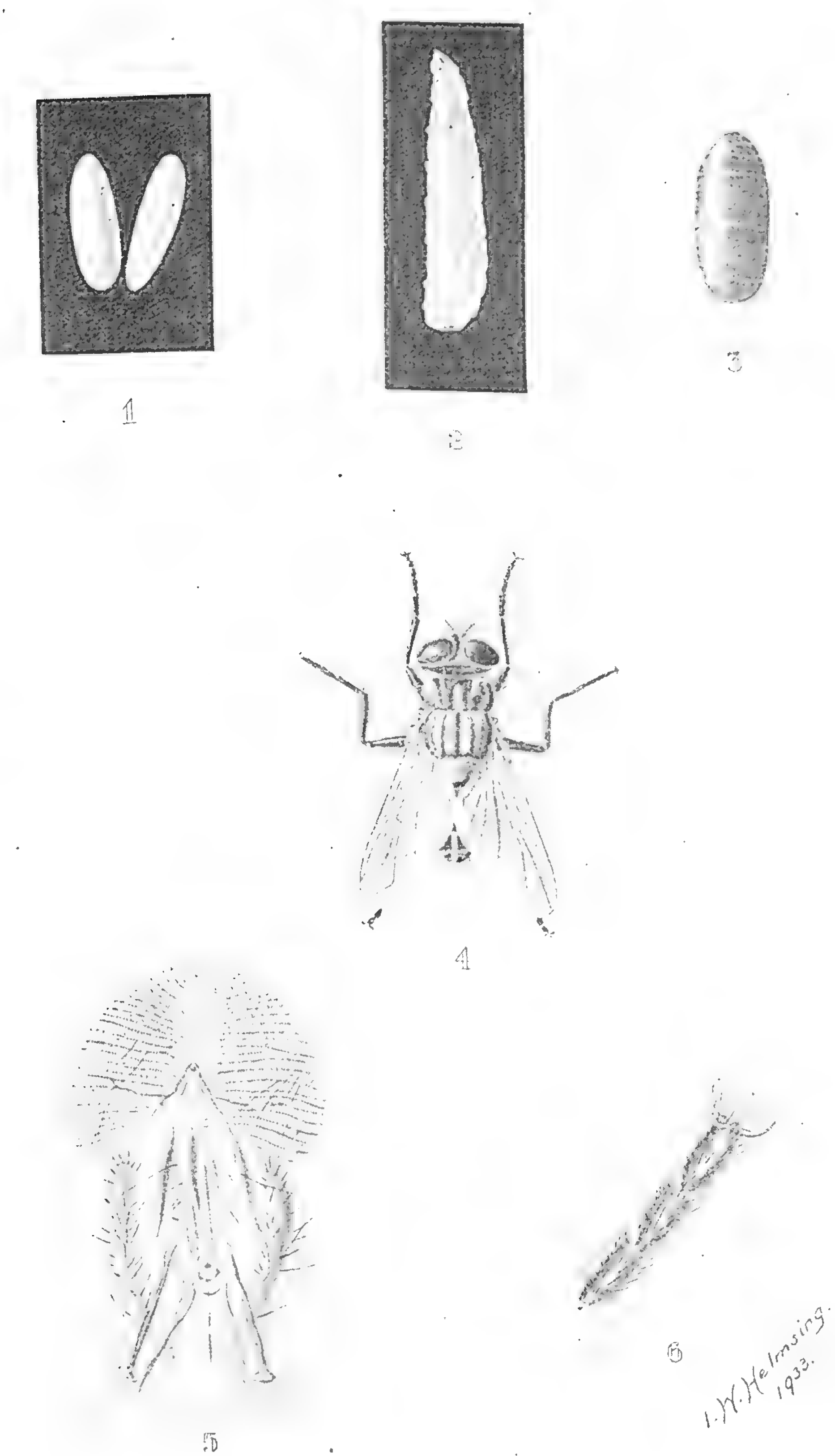

PLATE 13.—HOUSE FLY (*Musca domestica* Linn.).

Fig. 1.—Eggs × 15.
Fig. 2.—Larva × 5.
Fig. 3.—Puparium × 5.
Fig 4.—Adult × 5.
Fig. 5.—Proboscis × 34.
Fig. 6.—Foot showing claws and pad × 34.

Life-history.

The eggs are laid in batches of about 110 to 150 eggs, in fresh manure, garbage, fæces, and decaying vegetation. They hatch usually in from 8 to 24 hours, the time varying with the temperature.

The larvæ or maggots may be found in squirming masses within a few inches of the surface of infested material, but if the material is soft and moist and not subject to excessive internal heating, the maggots may penetrate throughout. At the end of about five days in warm weather the maggots achieve full growth, and they move then to a suitable spot in which to pupate, the ideal site for pupation apparently being moderately damp soil giving easy penetration. Pupation may occur at depths varying from little more than 1 inch to 2 feet, the latter being recorded in sandy loam.

The pupal period lasts approximately three to five days in warm weather, but great variation in this period may occur according to the temperature conditions, development being slower with low temperatures.

This period constitutes the time during which the marked change from larva to adult is taking place, and it is terminated by the complete development and the emergence of the adult insect. The adult fly commences to feed soon after emergence, but egg-laying does not occur until after a lapse of ten days to a fortnight. It will be seen that a complete generation from egg-laying to egg-laying may occupy only a little over three weeks in warm weather.

Habits and Menace of the Adult Fly.

In the matter of food, the house fly has most varied tastes; moist garbage and horse manure are just as attractive as man's most carefully refined food. Further, it is essential for the fly to visit putrefying material in order to lay its eggs. As has been pointed out, contaminating material will be caught in the hairs clothing the body, and on the claws and sticky pads of the feet, and on the extruded tongue. These, taken together, constitute only one section of the danger, however. It has been definitely proved that viable bacteria capable of causing human diseases, such as typhoid and tuberculosis, among many others, may be recovered from the alimentary canal of the house fly several days after infection. This means that the familiar fly specks are potentially infective material.

Natural Control.

The fluctuations in the number of flies are largely due to variations in temperature. The high summer temperatures induce rapid breeding, and if they are accompanied by high humidities, then the breeding sites are kept suitably moist. Low temperatures increase the length of the developmental period, thus slowing up the rate of breeding, and at the same time rendering sluggish the adult flies that are present.

The house fly is subject to attack by parasitic organisms, the most notable being the fungus *Empusa muscæ* Cohn. The spores of this organism give rise to a growth of white fungus which ramifies and distends the body of the insect. Swollen, sluggish, and dead house flies will probably often have been observed by householders. The effects of the fungus are most marked in the late summer and autumn months, when large numbers of the flies are killed in this manner.

Spiders and various predatory insects such as mantids, robber flies, and wasps of various families, all take their toll of the adult house flies.

The eggs, larvæ, and pupæ are liable to attack from insects such as ants and ground beetles.

Artificial Control.

The artificial control of the house fly and the elimination of danger from it may take a threefold form:—(*a*) Exclusion; (*b*) elimination of breeding sites; (*c*) destruction of the adults.

Exclusion.

Infants and patients should be protected from the attentions of flies by mosquito nets or other comparable means of exclusion. Foodstuffs and cooking utensils should be adequately covered and suitable gauze-screened cupboards should be provided for fresh foods. Infants' food, feeding bottles, milk, and so on should be most carefully protected. In cases of severe and more or less permanent infestation of buildings by flies, serious consideration should be given to the complete screening of all doors and windows.

Elimination of Breeding Sites.

With the growth of motor transport, the number of stables in city areas tends to decrease, and in those that remain the breeding of flies is now less possible than formerly because stable owners must take suitable precautions to prevent accumulations of manure.

There are, however, instances where manure must be stored for short periods, and it has been found that heaps of manure, if closely packed, become so heated by the processes of fermentation and permeated by the resultant gases that fly-breeding is restricted to the outermost layer of an inch or so. The heaps should be formed into a compact, almost rectilineal shape, and carefully smoothed on the sides and top by blows with the back of a shovel. The use of a borax spray composed of 1 lb. of borax in 6 gallons of water will satisfactorily deal with the insects breeding in the outer layer. As excess borax in the soil is injurious to plant growth, it has been recommended that not more than three gallons of this spray should be applied to 10 cubic feet of infected manure, and not more than 15 tons of borax-treated manure per acre be distributed in the soil.

For mounted army forces and farms, the method of drying manure may be useful. The process simply consists of spreading the manure in a thin uniform layer so that it dries quickly in the sun, thus rendering it unsuitable to the fly for oviposition. An area of flat hard ground should be selected and a rotation of freshly-placed manure, dry manure, and bare ground could be kept up in order to deal with fresh accumulations. The drying manure should be raked over. When dried the manure could be stored safely for agricultural purposes. It will be understood, however, that manure dried in this manner would have a diminished fertilising value, and it would be useful mainly because of the humus it would provide.

In city areas, the control of the house fly generally depends on the care taken in garbage disposal, and garbage should accordingly be placed in a fly-proof garbage tin. Regulations regarding the building

and care of household conveniences are in force, and each householder should see that so far as he is concerned, the regulations are strictly obeyed.

Destruction of the Adults.

The adult flies that gain access to a building may be dealt with in a variety of ways, as for example swatting, the use of sticky fly-papers, fly sprays, and trapping.

There are several brands of fly sprays on the market, and these generally consist of definite contact insecticides, which kill either on actually wetting the insect or as partial fumigants as a result of the fumes that are liberated when the fluid is sprayed in a fine mist.

A home-made spray may be somewhat inexpensively prepared by stable owners and farmers. The recipe is as follows:—½ lb. of pyrethrum is stirred into 1 gallon of kerosene and the mixture is agitated at intervals for two hours. Settling is then allowed to take place and the resultant clear amber-coloured fluid is later decanted or syphoned off. This spray fluid, if prepared with water-white kerosene, may be safely sprayed in furnished rooms. Householders, however, will usually find it more convenient to purchase one of the ready-prepared sprays.

It is advisable to sweep up and burn the flies that fall as a result of spraying, as a number of them may merely be stupified and, if left, may later recover.

Traps of a multiplicity of designs have been used for house fly control, the most commonly known type being the glass bottle trap with the entrance in the bottom and with an internal trough. The trough holds a fluid which serves both to lure the flies into the trap and also to drown them. Various fluids may be used for baiting this style of trap, including milk and stale beer.

Trapping should, however, be a somewhat needless procedure, or at least it is a method to be adopted only as a last resort. If flies are sufficiently numerous in a building to warrant the use of traps, then all efforts should be directed to the elimination of the source of the flies and, if necessary, to the adequate screening of the building.

Worms in Sheep.

A NEW AUTOMATIC DRENCHER.

Drenching sheep for worms has become so general in parts of Queensland that people using their ingenuity to simplify the operation deserve every possible encouragement. There has been invented an improved gun called the P. D. J. Automatic Gravity Drencher, which gives every satisfaction. The gun is simple in construction, and does its work well. The feed is by gravitation. Subjoined is a description of the new drencher, which is sure to interest sheep men, especially those engaged in lamb-raising.—Ed.

A NEW type of drenching gun for the treatment of worms in sheep is now on the market, and its efficacy has been proved by a comprehensive series of practical demonstrations. Officers of the Sheep and Wool Branch are impressed with its usefulness as an essential part of the ordinary veterinary equipment of a well-managed sheep farm, especially in those districts where lamb-raising is extensively practised.

The new gun is the invention of a veterinary surgeon, and is an improvement on any model so far used in Queensland. It is entirely a Queensland invention and product manufactured in Brisbane. The complete outfit consists of a nickel-plated copper container, a connecting tube, and the gun itself. The container is sold in two sizes, one holding half a gallon and fitted with a flexible tubing, and the other holding a gallon fitted with a rubber hose connection. In the design special attention has been given to the filter caps and shut-off taps. The aim of the designer was to evolve an instrument scientifically accurate, with the force of ejection controlled by trigger pressure, and in this he has succeeded. The gun recharges automatically on the release of the trigger and a fresh dose is sucked in to an accurately adjustable quantity. The dosage is regulated by means of a knurled screw-head at the butt of the gun—a simple arrangement by which an accurate dosage may be administered to the affected sheep.

The registered name of the new outfit is the " 'Ject-in' Sheep Drenching Gun," otherwise known as the "P.D.J. Automatic Gravity Drencher." The smaller size is intended for the administration of carbon tetrachloride or tetrachlorethylene and has a dosage range of from five to ten cubic centimetres. The larger size is designed for the administration of copper sulphate or arsenical drenches, and can be adjusted easily to a dose of either one or two ounces.

The new drencher combines the two essential features of such an apparatus—accurate dosage and ease of use. Altogether the "Ject-in" gun is one of the most satisfactory we have yet seen for the purpose of drenching sheep, and its low cost is a further recommendation. Summed up, its chief points are accuracy, efficiency, and cheapness.

Details of the New Drencher.

The new gravity drencher consists of a brass cylinder of accurate capacity, with a suitable nozzle at one end, for inserting in the sheep's mouth, and, at the other end, an inlet tube for connecting the drencher

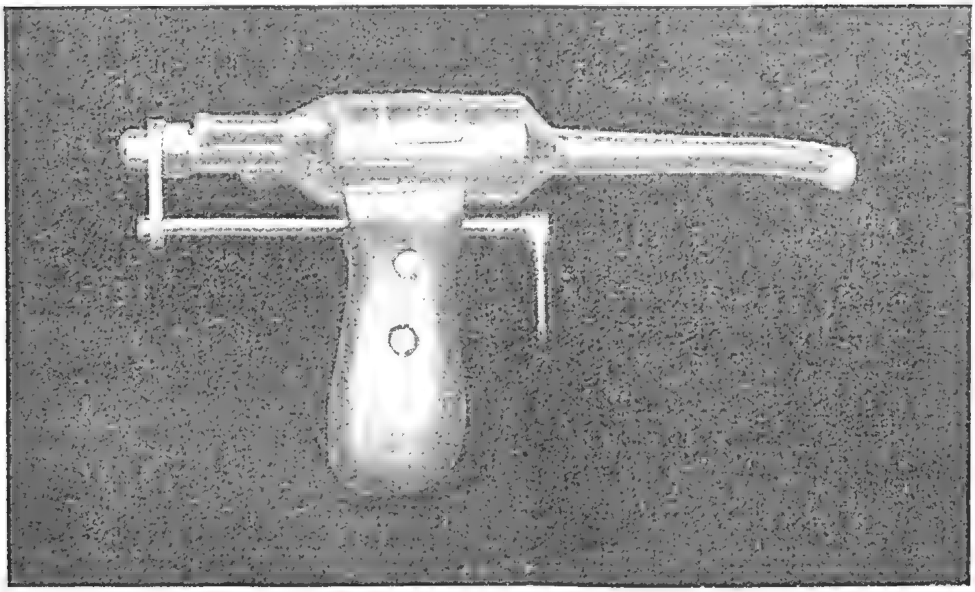

PLATE 14.
The "Ject-In" Sheep-drenching Gun—A new automatic apparatus of Queensland invention and manufacture.

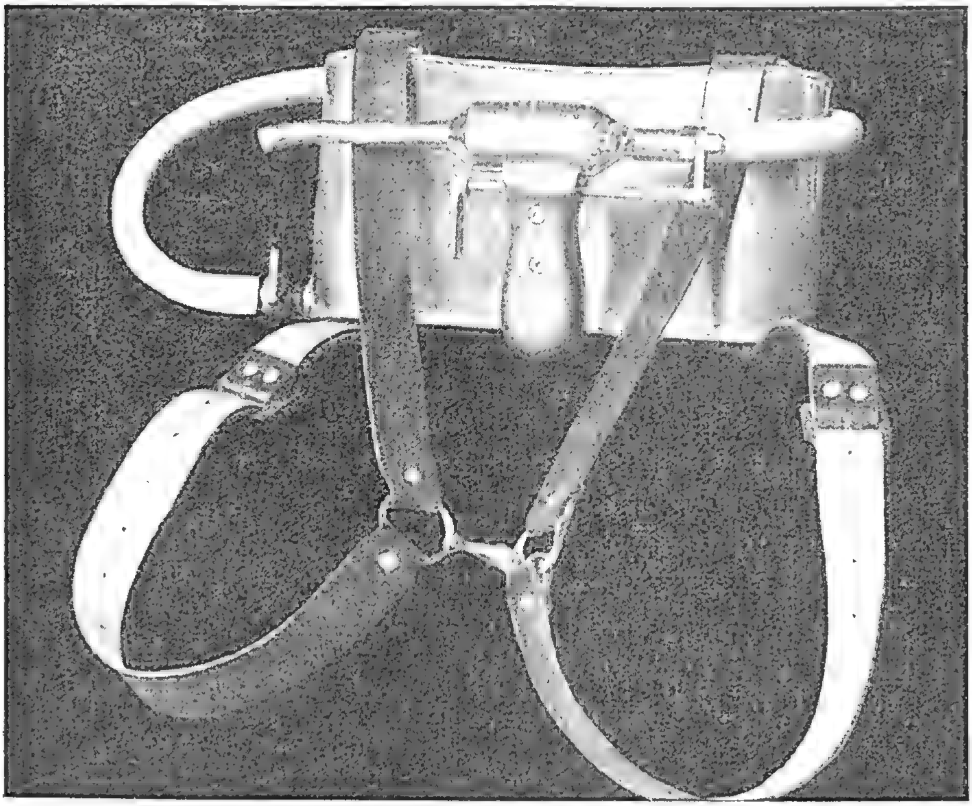

PLATE 15.
Knapsack container for the "Ject-In" Drencher for sheep.

to a suitable reservoir. Beside the inlet tube is a double acting air valve, which allows the air to be expelled from the cylinder when filling, and allows the air in, to deliver the dose.

The drencher has a pistol grip fitted on side of the cylinder, with a trigger attached to a rod moving parallel to the axis of the cylinder. This rod is connected in turn to the valve spindle, which with the valves works through the central axis of the cylinder. The valve spindle actuates both the inlet and outlet valves, which are so arranged that, normally, the inlet valve is opened and the outlet valve is closed and held in that position by a spring. On pressing the trigger against the spring the inlet valve is closed first and then the outlet valve opens to deliver the dose. The outlet valve cannot open before the inlet valve is closed, so it is impossible to get an overdose. On releasing the trigger the valves return to normal.

It should be noted that the gravity supply of the drench to the sheep refers only to the dose itself (1 or 2 oz.) and has no bearing on the supply in the reservoir as that is cut off immediately the inlet valve is closed, and only the dose itself runs into the sheep's mouth by gravity. In this way the drencher functions perfectly, with a full reservoir down to the last dose in it. All metal parts of the drencher are of brass, nickel-plated, and will withstand any chemical action due to the drench in use.

The drenching outfit generally supplied consists of two separate drenchers—1 and 2 oz. respectively for lambs and sheep, a 1-gallon reservoir (made of brass) with straps to hold it on the operator's back, and length of suitable hosing to connect the drenchers with the reservoir.

The drenchers are of simple construction, with no parts to get out of order, very strong, and guaranteed to stand a fair amount of rough usage—but not abuse. The new gun is very fast in action, in fact a 1-oz. drencher can be used on sheep, if necessary, by simply pressing the trigger twice. It can be easily cleaned by flushing with hot water. The drencher is so constructed as to withstand the corroding influences of bluestone and arsenic, and with ordinary use should last a lifetime with minor replacements.

In operation a knapsack is carried on the back and a handy length of hose piping conveys the drench to the gun. The grip is a good one, and just sufficiently strong to release the dose as slowly or quickly as desired. The mouthpiece is sufficiently bent to make the actual operation of drenching convenient.

The gun is constructed to administer a 1 and 2 oz. drench.

The gun has been tested carefully in the matter of correctness of dose. In use the apparatus proved handy and efficient, and may be regarded as a labour saver in no small degree. Moreover, its price is reasonable.

Banana Weevil Borer Control.

By J. A. WEDDELL, Assistant Entomologist.

THE present seems to be a suitable time at which to restate the position regarding the methods of control of the banana weevil borer. Permits for the planting of a large number of suckers have been issued, new districts are being opened up, and new growers are entering the industry. For his own sake, each grower must keep his plantation in a clean and healthy condition; if he does not do so, then steps will be taken to ensure the protection of neighbouring growers.

Essentially satisfactory control of the banana weevil borer depends on fore-knowledge leading to suitable preventive treatment, followed by consistent baiting throughout periods of apparent freedom from attack. There are a few main facts connected with the life-history and habits of the insect which have a direct bearing on control; once these are accepted the control recommendations are seen to be simple and obvious.

1. The eggs are laid into the banana plant tissue at or about ground level. They are inserted to a depth of about one-twelfth of an inch into a cavity eaten out by the female. Almost immediately afterwards sap exudations seal the egg in the cavity. The egg is thus safe from outside influences unless the outer tissue of the plant is removed.
2. It is the larval stage of the insect that causes the economic damage to the plants. The grub tunnels within the corm without breaking to the outside, and consequently it also is protected from direct control measures.
3. The insect pupates within the food tissue and this resting stage, during which transformation to the adult takes place, is also protected.
4. The adult feeds moderately, but the danger from it lies in the fairly continuous egg-laying during a long life. The beetles are quite active in dark places, and they shun the light; this suggests activity at night. If disturbed they sham death. The favourite sheltering spot in a plantation is in old rotting banana plants and the rotting butts. The adult is the only stage in which external feeding and wandering takes place, and routine treatment in the plantation can be directed only against the adult.

Plant Clean Suckers.

Every new area should start off with clean suckers, and the following points should be observed:—

1. The source of the suckers should be a beetle-free plantation, or one with only a light infestation in which control measures have been consistently carried out. It must be understood that this brief statement does not deal fully with the conditions under which suckers may be obtained, but gives only the broad outline. Growers should make themselves acquainted with the current planting policy as laid down by the Banana Industry Protection Board; particulars may be obtained from the local agent of the Board.

2. The suckers selected should, at the time of digging, be healthy and show no signs of banana weevil borer damage.

3. The whole of the corm of each sucker should be completely peeled to a thickness of about $\frac{1}{8}$ inch. If in the course of this paring a larval tunnel is disclosed, the sucker should be rejected; in a few cases it may be possible to cut away a shallow infestation and leave only clean white tissue without destroying the sucker. The paring will thus ensure that larvæ are not present within the sucker, and at the same time will remove any eggs that may be lying unhatched in the surface tissue. This paring of the sucker and the consequential removal of the roots will not affect subsequent growth.

4. The suckers should be bagged and removed from the plantation before nightfall. Consequently, the suckers cut each day should be limited to the number that can be treated and carted away.

5. If desired the selected suckers may be sent unpared from the parent plantation, provided they are bagged and carted away before nightfall. On arrival at the new area they should be immediately pared as described above at some distance from the actual plantation; the parings and any rejected suckers should be immediately destroyed. Burning, or the spreading of the parings in the sun for quick drying, and chopping the rejected suckers into small pieces and spreading to dry are satisfactory methods, with the preference on the burning.

Bait the Plantation Regularly.

The standard poison for use against the banana weevil borer consists of one part of Paris green mixed dry with six parts by weight of flour. The most convenient quantities are 1 lb. Paris green and 6 lb. flour. These should be placed in alternate layers in a large tin with a tight-fitting lid and then well shaken together. It must be remembered that Paris green is a strong arsenical poison, and it should be stored and handled with care. The only apparatus needed for the application is a castor tin with fine holes. A $\frac{1}{2}$-lb. cocoa tin with fine perforations in the lid makes a satisfactory poison carrier.

A careful watch should be kept in a young plantation, and any suckers which, by slowness of growth or death of the centre leaf, show signs of borer attack should be dug out, and if the suspicions are confirmed should be destroyed by slicing into small pieces for quick drying in the sun. The hole may then be replanted with a clean sucker.

As the plantation grows the stage will be reached when desuckering of unwanted eyes will be necessary. As each sucker eye is cut off or gouged out, the newly-cut tissue should be lightly but evenly dusted with the poison mixture. The butt of the sucker eye may also be cut off, dusted, and loosely replaced in position. The extra work involved in making of each cut surface a poison bait is simply that of carrying a small tin of the poison mixture. The implements for desuckering should always include a tin of 1 in 6 mixture.

The spent plants in mature plantations should be adequately dealt with after the bunch has been removed. The old plant should be cut off at not more than 6 inches from the ground, split up longitudinally, and cut across not less than four times. This ensures that the plant tissue will lie open, dry quickly in the sun, and be quickly rendered unsatisfactory as a breeding site and a shelter for the adult beetles. In the case of beetle-infested plants, it is required by regulation that the butt remaining be converted into a poisoned bait. The method is as follows:—

The plant is cut down, as above described, at not more than 6 inches from the ground, and the butt is again cut at or near ground level. This forms a separate slab a few inches thick, which should be dusted evenly on both surfaces. The upper surface of the butt should then be dusted and the dusted slab loosely replaced, preferably with a small stick or stone between.

Other methods of making poison baits of the old butts have been used, and these have given satisfaction. The two following descriptions may be of interest:—

Method 1.—The plant is cut off as close as possible to the ground and chopped up. With a suckering tool a deep cone is cut out of the centre of the butt. The surfaces of the butt, the cavity, and the cone are evenly dusted, and the cone is then loosely replaced.

Method 2.—This is the same as the preceding method, except that instead of a cone a deep wedge is chopped out of the butt with a cane knife or mattock. After dusting, a tiny stone in the cavity will ensure that the wedge does not fit too tightly when replaced.

Each of the above methods provides a poisoned cavity which will afford shelter to the beetles and remain moist, and therefore attractive for some time. A little trash over each bait will increase the period of attractiveness by delaying the drying out. The thickness of the dust application is rather important. What is required is a thin but even dusting or peppering of the tissue; undusted freshly-cut areas would provide attractive and safe feeding sites for the beetles, while thickly-coated areas would not be sufficiently attractive.

Two reasons for discouragement regarding baiting may influence some growers. The first is that complete eradication of the beetle may be expected by some, and a method which does not give it will be criticised. Complete eradication is an almost unattainable ideal; what can be accomplished is to reduce and keep the beetle population at a level where it will cause little or no economic loss. The second is that growers are often dissatisfied with the proved kill in the form of dead beetles in or near the baits. Remember that some hours will elapse after feeding before the insects die from Paris green poisoning, and in that time they may crawl to fresh shelter, and later they will be disposed of by ants and other scavenging insects.

The methods above described of making each fresh-cut surface into a poisoned bait, whether in suckering or after cutting the fruit, will ensure that at least two fairly fresh baits are present in each stool throughout the year—in other words, approximately 1,000 baits per acre. The cash outlay for materials is a few shillings, while the extra labour involved is negligible.

Queensland Grasses*.

By C. T. WHITE, Government Botanist.

THE known native grasses of the State, compiled from a list made by Mr. C. E. Hubbard, of the Royal Botanic Gardens, Kew, England, who spent about twelve months as a botanist on the staff of the Queensland Department of Agriculture and Stock, number about 450 different kinds or species. To these must no doubt be added another fifty yet to be scientifically catalogued and described, bringing our grass flora to a total of at least 500 species. Is it not natural to assume that among these we have some of outstanding merit and worthy of every attempt to distribute and improve?

Native Pastures.

Before dealing with any grasses specifically, it may be as well to give a brief general account of our native pastures. Excellent cattle pasturage exists along much of the coastal portion of the State. Typical tropical savannah forests, consisting of low eucalypts, wattles, and other trees, with an undergrowth of grasses and herbage, are found over much of the Cape York Peninsula, improving as one comes south to the Gulf country, where a great mixture of grasses and herbage occurs in the pastures, among the better grasses being Blue Grasses, Kangaroo Grasses, Flinders Grasses, Star Grasses, Couch Grasses, Love Grasses, Panic Grasses, and native Paspalums, Setarias, and Sorghums. Southward from Ingham, through Townsville to Proserpine, there is a "dry" belt. The native pastures are mostly coarse in appearance, and in a lot of the open forest country Blady Grasses and Spear Grasses predominate. During the wet season some of the larger grasses, such as the Tall Spear Grass (*Heteropogon triticeus*), the native Sorghums, &c., grow to a great height, eight to ten feet or even more. Some of the best pastures in the open eucalyptus country are composed of Kangaroo Grass in almost a pure stand.

Of recent years anywhere near a settlement *Chloris barbata,* an ally of the Rhodes Grass, and noticeable on account of its purple heads, has become an outstanding grass in the native pastures. It has been highly spoken of, but it is rather doubtful if it has any great value. The common tropical weed, *Stylosanthes mucronata,* the so-called Townsville Lucerne, has spread everywhere, greatly improving the pastures. Cattle are very fond of this leguminous plant, and analysis shows its feeding value to be high. Unfortunately, it is only of annual duration, and dies out on the approach of the dry winter and spring months. Some native legumes enter into the composition of the pasture, notably species of *Alysicarpus,* of which the most important is *Alysicarpus vaginalis.* These are worth every encouragement, and where allowed to seed and reproduce naturally for a season or two, treble or more the carrying capacity of the land. From Proserpine southwards to Koumala the rainfall is high, but the pastures are poor. This is essentially sugar country, however, and stock-raising is of little importance.

Southward to about Gladstone is another "dry" belt. The pastures improve considerably, carrying in many cases a very heavy mixture of species, though they suffer severely from continued dry spells, parti-

* Paper read before the Royal Society of Queensland, 23rd October, 1933.

cularly in the winter and spring months. Among the grasses composing the pasture are different sorts of Blue Grasses, Kangaroo Grasses, Star Grasses, Couch Grass, Love Grasses, Native Millets, Cockatoo Grass, and others.

In some parts of Central Queensland, such as the Dawson Valley, native pastures are those of the coastal type, except that some of the better western grasses, such as the Mitchell Grasses, Flinders Grasses, and some of the better Panic Grasses, intrude.

In the Burnett, Lockyer, and Brisbane Valley areas, the better open eucalyptus country supports native pastures for the most part of a rather high order, consisting of a general mixture of Blue Grasses, Panic Grasses, Kangaroo Grasses, &c. Herbaceous plants, comprising a fair number of legumes, are also a feature of these pastures. Unfortunately, a wide area of this country has suffered badly through overstocking, with the consequence that the better mixtures have been eaten out, leaving, in many cases, almost a pure stand of the Bitter or Pitted Blue Grass (*Amphilophis decipiens*).

An interesting feature has been the alteration in some localities, particularly near the larger towns of the South, of the composition of the native pasture. In most cases this has deteriorated through overstocking, but in many cases the original mixture has given way to pastures almost entirely composed of the Blue Couch (*Digitaria didactyla*), and here and there in smaller areas the common Couch (*Cynodon dactylon*), and this must, I think, be regarded, on the whole, as improving the carrying capacity of the pastures.

A distinct type of pasture in coastal Queensland is the fresh-water swamp pasture of a high grazing value. In this the most important grasses are the Water Couch (*Paspalum distichum*), White Water Couch (*Panicum obseptum*), Rice Grass (*Leersia hexandra*), Native Millet (*Echinochloa crus-galli*), and *Hemarthria compressa*. Along the whole of the coastal belt a distinct type of pasture is the salt-water meadow, which in most cases consists of a pure stand of the Salt Water Couch (*Sporobolus virginicus* var. *minor*). In the more muddy places towards the edge of this pasture the Salt Water Couch may give way to the Salt Water Paspalum (*Paspalum vaginatum*).

Pastures of Western Queensland.

The pastures of Western Queensland are of a sufficiently high standard to be famous throughout Australia. Of the grasses composing the pastures, the best known are the Mitchell Grasses, Flinders Grasses, native Panic Grasses, Blue Grasses, better-class Star Grasses, and Love Grasses, &c. Here and there on the Darling Downs and in the Granite Belt Danthonia Grasses, such as *Danthonia pallida, Danthonia racemosa,* and *Danthonia longifolia,* are of some importance, though not nearly to the same extent as they are in the colder places further to the south, such as the New England Tableland. Annual herbs following the summer rains are a feature of much of the grass land. These belong to a great range of families, the Amaranths, the Saltbushes, the Legumes, and the Mallows being among the most valuable.

Mitchell Grasses.

Now to deal with some of the grasses individually. Undoubtedly the grasses most associated with Australia, both in the country itself Though Mitchell is generally regarded as the discoverer of Mitchell who found *Astrebla pectinata* near Condobolin and on the plains of the Bogan in New South Wales in 1836. These were described at the time by the great English botanist Lindley as *Danthonia pectinata,* and are to be found preserved at the present time at the Museum and Herbarium of the Department of Botany of the University of Cambridge, England. Though Mitchell is generally regarded as the discoverer of Mitchell Grass, specimens had already been collected by both Cunningham and Fraser as early as 1817, though apparently they remained undescribed, and indeed unrecorded at all, until C. E. Hubbard, when monographing the genus, found the specimens at the British Museum of Natural History, London. The Mitchell Grasses are widely spread over the heavy blacksoil plains of Northern Australia, Central Australia, Queensland, and New South Wales, but finding their greatest development in Queensland. The genus is confined to Australia. Four distinct species are to be recognised:—

1. *Astrebla pectinata,* often known as the Common Mitchell, is the commonest form in New South Wales, but is comparatively rare in Queensland. It has a wide distribution through Central Australia to Western Australia, but in the last-mentioned State is, I understand, very rare.

2. *Astrebla lappacea,* known as the Wheat-eared or Curly Mitchell. This is the form most abundant in Queensland. Like the Common Mitchell, it has a wide distribution, but is nowhere so abundant as in Central Queensland. It has a long wheat-eared seed head, and is probably the most important species of the genus from an economic standpoint. In the older literature it is referred to as *Astrebla triticoides,* but this excellent specific name has, unfortunately, to give way on account of priority to *Astrebla lappacea.* This latter name was used by Lindley as far back as 1848, when he named the grass *Danthonia lappacea,* based on specimens collected by Sir Thomas Mitchell, near Mitchell, Queensland, in 1846.

3. *Astrebla squarrosa* is the Bull Mitchell, moderately common in parts of Central and North Queensland, also found in the Northern Territory and the north-west of New South Wales. It is a coarse species not occurring in such great quantities as *Astrebla lappacea.* Its economic value is not quite clear at the present time, though it does not seem to be the equal of the common *Astrebla lappacea* as a stock grass. It yields a very large seed, however, and a correspondingly large grain, and if Mitchell Grass has any importance in the future as a grain crop *Astrebla squarrosa* may prove of considerable importance.

4. *Astrebla elymoides.*—This is variously known as the Hoop Mitchell, Wire Mitchell, and Weeping Mitchell. It is very distinctive looking from all the others, and has a wide distribution through the north-west of Western Australia, Northern and Central Queensland to New South Wales. It is quite a good fodder grass, but suffers in comparison with its better relatives.

Flinders Grasses.

Ranking next in importance to the Mitchell Grasses in the eyes of the pastoralists of Northern and Western Queensland are the Flinders

Grasses, of which at least four distinct kinds have now been recognised. They all belong to the genus Iseilema, which is composed, so far as known, of nine species, five of which are found in tropical Asia and four in Australia. Until recent years all the Australian kinds were looked upon as forms of one species. During the summer months of 1909-1910 the Czecho-Slovakian botanist, Dr. Karel Domin, botanised extensively in Queensland, and he paid special attention to the grasses, making extensive collections. He recognised four distinct species among the grasses known collectively as Flinders Grass. Of these I think the most abundant, and fortunately the best of the genus, is *Iseilema actinostachys.* The value of Flinders Grasses lies in their peculiar habit of growing very quickly during the rainy season, soon dying off, but being extremely palatable and nutritious in the form of standing hay, in this respect surely differing from all other known grasses. The nutritive value is due to the amount of grain produced and the peculiar way in which it is borne among small leaves over almost the whole plant. The Flinders Grasses are extremely brittle when dry, but all stock greedily lick up the broken pieces and do well on them. As a hay crop for dry tropical and subtropical regions with a short summer rainfall season, the Flinders Grasses are probably unequalled, making up in high nutritive value what they lack in bulk.

Blue Grass.

Extremely important on the Downs country of Queensland and New South Wales, and particularly in this State, is the Blue Grass, *Dichanthium sericeum,* in its typical form distinguishable in the field by its bluish-green colour, luxuriant appearance, and soft silky seed heads. A number of forms are distinguishable, and they are at present under review by Mr. C. E. Hubbard, whose classification of them is looked forward to by botanists and agrostologists. One may say, "Why worry about the finer points of the classification of these grasses at all? Where does it lead?" But surely it is hardly necessary to point out that a good sound botanical classification is the basis on which all future work on the improvement of the grasses by selection and hybridisation rests. Blue Grass has an exceptionally high reputation as a fodder among pastoralists. It is usually one of the earliest grasses to shoot in response to spring and early summer rains, but is not particularly drought resistant. It makes one of the best grass hays possible, and as it produces an abundance of seed it is worthy of study from the agrostologist and plant breeder. E. Breakwell, in his excellent book on "The Grasses and Fodder Plants of New South Wales," states that it has been found that the smallest and plumpest spikes produce the best seed.

Panic Grasses.

Forming a very large percentage of the bulk of the average native mixed pasture are the various sorts of Panic Grasses. These were all included in the earlier works on Australian grasses under the genus Panicum. This genus has now, however, been divided into numerous smaller genera, the genus Panicum itself, in a restricted sense, being comparatively small, and including, for the most part, grasses with widespreading, much branched, seed heads, such as *Panicum decompositum,* often referred to as Native Millet, *Panicum trachyrachis,* Coolibah Grass, *Panicum prolutum,* Coolah Grass, and a number of

others, common enough in the pasture but lacking distinctive local names. As at present understood, twenty different kinds of Panicums, or Panic Grasses proper, are found in Queensland.

Paspalidium Grasses.

Of the grasses split from the Panicums are those forming a group now known as the Paspalidium Grasses. Paspalidium is a small genus of about sixteen species, of which ten are found in Australia, all the Australian species being found in Queensland, though most, of course, extend to New South Wales and the Northern Territory. They are remarkable for the great amount of grain they carry in narrow, spike-like seed heads. Most of them are extremely palatable. The largest is *Paspalidium globoideum,* known as Shot Grass or Sago Grass in Queensland. It grows 3 feet to 4 feet high or more, is extremely palatable to stock, and bears a sago- or tapioca-like grain. This grain is borne in great abundance, and is one of the staple foods of the grain-eating birds in the west; in fact, one pastoralist, Mr. J. Garvey, of Fernlees, Central Queensland, in sending specimens of this grass along with other Paspalidiums, stated that the Budgeeragahs fed so heavily on the seed that the grass did not get a chance to establish itself properly. Among the smaller growing Paspalidiums are several known as Brigalow Grasses or Wallaby Grasses. Prominence has recently been given to one of these in a paper before the Royal Society of Queensland by Dr. E. Hirschfeld, and following this a good deal of interest has been focused on this particular grass. Since the reading of Dr. Hirschfeld's paper I have had several specimens from different pastoralists, along with some valuable notes. Particularly am I indebted to Mr. J. Garvey, of Sandhurst Park, Fernlees. A series of specimens from him with notes attached is exhibited herewith.

Paspalidium flavidium is a large species intermediate between the smaller Brigalow Grasses and the Shot Grass or Sago Grass, *Paspalidium globoideum.* Of the Brigalow Grasses proper we can now, I think, recognise at least three distinct species, namely: *Paspalidium gracile, Paspalidium distans,* and *Paspalidium caespitosum.* At the present stage of our knowledge I do not care to state which is the best. Probably the values are more or less similar; but, in any case, they represent a very fertile field for intensive work by agrostologists in the future.

Many other grasses go to make up the mixed native pasture—Love Grasses, Kangaroo Grasses, Oat Grasses, Star Grasses, &c.—but time does not allow to deal with these in any detail. However, farmers, pastoralists, and others are invited once more to forward specimens of grasses and herbage to the Department for identification and report.

Agricultural Notes.

By H. S. HUNTER, Agricultural Branch.

Seasonal Prospects.

THE year 1934 has been ushered in in the midst of a bounteous season as a result of well-distributed and profitable rainfall, which, commencing in the winter months, continued at regular intervals of short duration throughout the spring and early summer.

Although some districts may have experienced a lack of moisture at some time during the spring months, and others a surfeit of wet weather, the season generally is regarded as the best within the memory of persons who gain their livelihood from the products of the soil.

A pleasing feature of the improved conditions is that good soaking rainfall has extended to the inland pastoral areas, some parts of which have been in the grip of drought for a number of years. In the Central-West, there is an encouraging revival in pastoral activity, following on the resuscitation of pastures, the replenishing of water supplies, and the rise in wool values.

In the agricultural areas, the principal industries largely have been in a state of over-production, with, as a consequence, low market values for market products; but, nevertheless, a land hunger is in evidence, as witness 1,143 applications for three blocks of land opened for selection recently in the Chinchilla district.

Sugar.

Along the tropical coast a bumper sugar crop is expected owing to phenomenal winter rains, and it is anticipated the total yield will break all previous records. Many mills will exceed their peak as allotted under the "peak year scheme." The heavy production this year has brought up the question of restricting individual acreages, and the matter will be considered at a conference to be held within the course of a few weeks. The advance payment for sugar produced in excess of the peak is being made on the basis of £5 12s. per ton.

Wheat.

Most of the wheat crops have been affected to some degree by continuous wet weather immediately prior to and during harvesting, which resulted in the lodging of the crops and the bleaching of the grain. In some districts, where harvesting operations were not unduly delayed, little damage was sustained by standing crops, but where bagged wheat was caught lying in the field, the grain suffered.

Unfortunately, earlier expectations of a record yield of high-quality grain will not now be realised, but, nevertheless some satisfactory returns have been obtained. For example, numerous crops of from 30 to 45 bushels per acre have been reported. Pittsworth probably will be hard to beat for the district average. On Mr. J. E. Bligh's "Anchorfield" property, at Brookstead, a 10-acre seed propagation plot, planted in co-operation with the Department of Agriculture, with the new "Seafoam" variety recently released from Roma State Farm, gave an average return of 49·8 bushels per acre. At Felton, the encouraging

return of 512 bags from 32 acres, or 48 bushels per acre, was obtained with the Pusa variety by Mr. M. Cooper. An adjoining paddock of Clarendon, carried an equally heavy crop, but owing to heavy infestation with convolvulus, it was possible to recover only an average yield of 36 bushels. Mr. F. Benn, of Apunyal, secured an average yield of $45\frac{1}{2}$ bushels of good quality wheat from a 6-acre area.

The Maranoa has experienced the best wheat season for many years and, although rains came at an inopportune time, the harvesting was not interfered with to the same extent as on the Darling Downs. A yield of fairly good quality grain is expected, which in quantity will overtax the existing storage facilities. One encouraging feature of the late rains in that district is that the soil is well stored with moisture, some of which, by immediate ploughing and thereafter periodical cultivation, can be retained until next planting season—a factor of importance to the wheat industry of the Maranoa.

Cotton.

An exceptionally heavy rainfall over the main cotton belt has made it difficult for cotton-growers to get on to their land and to keep weed growth in check, but, nevertheless, the season has been unusually favourable to the growing crops. It is estimated that approximately 85,000 acres have been planted, and experiences to date indicate a record harvest.

Peanuts.

A record crop also is in prospect with peanuts. Some 8,000 acres have been planted, and the Peanut Board is experiencing difficulty in meeting all orders for seed. The increase in area is due largely to the fact that for the first time in the history of the pool there is no carry-over from the previous season, and farmers had been enjoined to plant larger areas to meet Australia's peanut requirements. It is to be regretted that the Commonwealth Government since has lifted the embargo on the importation of Chinese peanuts, and as a consequence the crop will have to be marketed without that assistance.

Tobacco.

The usual difficulty is being experienced in raising seedlings owing to the ravages of disease, principally blue mould, and in many instances new seed-beds are being sown.

Considerable success has attended the use of sprays recommended by the Department, but in many instances the spray has been washed off the plants by the frequent rains. The period for transplanting to the field now is near at hand, and until this operation takes place, it will be difficult to forecast the area which will be planted with the crop this season. In the Texas and Inglewood districts where transplanting takes place earlier than nearer to the coast, it is apparent the area will be considerably below that of last year. In other parts reduced areas are possible, owing to numerous causes, including lack of finance, disease, and unsuitable soil. Early forecasts indicate increased areas in the neighbourhood of Mackay and Miriam Vale.

Large quantities of unsold leaf of the darker grades are proving embarrassing to the growers, especially where the proceeds from the last crop have not been sufficient to meet commitments.

Maize and Dairy Fodders.

The mid-season and late-planted maize crops are in excellent condition and, given a continuance of the favourable season, exceptionally good yields should result. Heavy yields of dairy fodders are assured; in many instances these are being harvested and converted into hay or silage.

The latter method is proving popular, as weather conditions have not favoured haymaking. For this reason lucerne is being ensiled to some extent. Although not suitable for this purpose when used alone, it makes excellent silage when mixed with maize or some other bulky fodder.

Fruit Crops.

The continuous rains have threatened the success of the early fruits from the Granite Belt by adversely affecting their flavour, but later fruits are doing well. Citrus and tropical fruits have excellent prospects of producing heavy yields. The citrus crop, which may be a record for the State, is expected to mature earlier than usual, and thus will be enabled to reach the local and Southern markets before the Southern-grown citrus fruits are available. The grant from the Fruit Industry Sugar Concession Committee to assist the pineapple-canning industry has been renewed for another year.

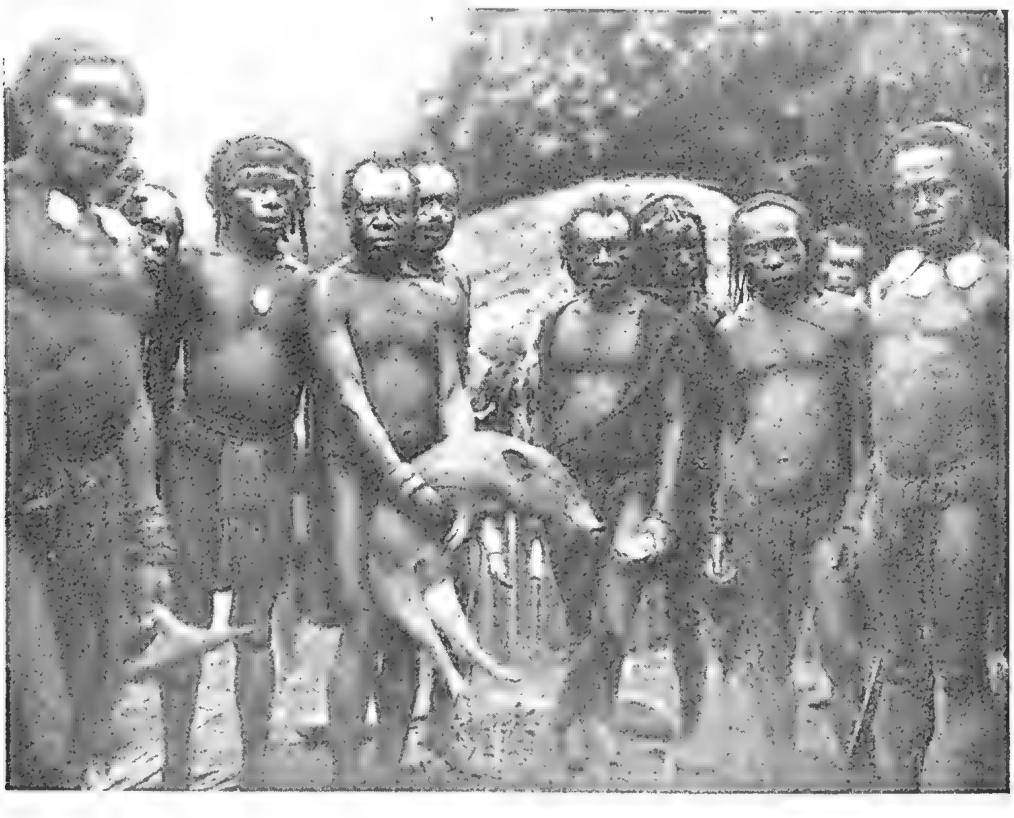

PLATE 16.—LIVE PORK FOR CHRISTMAS AT A NEW GUINEA HEAD HUNTERS' CAMP.

These Mohamato natives had previously been shooting arrows at passing survey men, so brought in a pig as a peace offering. They always roast their pigs alive, and the jungle is made hideous with the dying animal's cries.

PLATE 17.
Gatton Queen and her litter in the Large White section of the Piggery, Queensland Agricultural College, Gatton.

PLATE 18.
Piggeries at the Willowburn Hospital, Toowoomba, showing layout of yards.

PLATE 19.
A shady corner of the Pig Run at Willowburn Hospital, Toowoomba.

PLATE 20.
Gatton Dell and her litter in the Berkshire section of the Piggery, Queensland Agricultural College, Gatton.

The Premier's New Year Message.

PROGRESS TOWARDS PROSPERITY

THE year 1934 is being ushered in under more happy auspices than have obtained since the economic disturbance first began to manifest itself. Most parts of the State have shared recently in Nature's bounteous rains, which not only give encouragement to our citizens generally, but ensure the maintenance of the volume of production in our primary industries.

The rise in our wool prices, particularly, will mean a welcome increment in the national income of the State, the effect of which may be gauged from a comparison of the value of our exports overseas for the first five months of the current financial year up to the end of November last with the corresponding period of the previous year. The published statistics show that for the months of July-November of the current year, exports overseas from the State were valued at £2,400,000 more than for the same months of 1932-33.

A pleasing feature of recently published figures is the fact that the volume of employment continues to show progressive increases, and during the coming year it will be the Government's aim to implement this improvement in every possible way. The programme of works and development that will be undertaken in 1934 will not only provide further avenues of normal employment, but will be of much value in assisting commercial activity generally.

I earnestly hope that the coming year will bring with it an improved price level that will offer stability to all our citizens engaged in various kinds of industry. Events of recent years since the economic crisis asserted itself indicate the necessity for vital adjustments in order that undeserved poverty and the evils of unemployment might be banished from civilisation.

It can be accepted as an axiom that man's inventive genius and the application of scientific methods have been successfully applied in the realm of producing commodities that are essential for the welfare of the human race. The same energy, zeal, and activity are required in the solution of the concomitant problems of distribution and consumption.

I wish our citizens a Happy New Year, and sincerely trust that the State generally will continue its progress towards restored prosperity.

W. Forgan Smith

THE DAIRY INDUSTRY.

Supplied by the Dairy Branch.

NOTES ON STARTERS (LACTIC CULTURE).

Flavour and Aroma.

Scientific research has revealed that during the normal ripening period the development of flavour and aroma in starters is not proportional to the acid production, but a definite acidity such as 0.65 per cent. to 0.75 per cent. is necessary before the desired flavour and aroma become pronounced.

With continual growth of the organisms over-ripening results, giving off flavours and aromas that are sometimes very objectionable. Considerable acid development is necessary in a starter, but overacidity is undesirable. The exact range of acidity over which flavours and aromas are satisfactory probably varies with different cultures.

Acidity.

The composition of milk has an important influence on the acidity development in starters. It has been shown that there is a general tendency for a higher acidity to be developed by a starter in milk with a high total solids than in milk with a low total solids.

The amount of acidity developed by a starter is apparently a more or less definite thing and cannot be changed appreciably by varying the amount of inoculating material used in the production.

Over-ripening of Starters.

The term over-ripe in connection with starters refers to the holding of a firmly coagulated starter under conditions favourable for the growth of the contained organisms. The result of such continued holding is the development of an excessive acidity, and a more or less objectionable flavour and aroma. Excessive acidity is due to the failure of the acid, which caused the coagulation, to restrain the growth of the acid producting organisms, while over-ripe flavour and aroma are presumably due to the products formed by the bacteria either directly or through the action of such materials as acids and enzymes elaborated by them.

Effect of Temperature of Pasteurisation of the Starter Milk on the Rate of Coagulation of a Starter.

Results have shown that milk heated to 145 deg. Fahr. for thirty minutes developed acid, and coagulated more slowly than milk heated to a considerably higher temperature.

Essentially the same rate of growth of starter organisms occurred after heating to 160 deg. Fahr. for thirty minutes, as when a higher temperature was used for this period. Heating to a temperature of 180 deg. Fahr. for at least thirty minutes is the practice that is usually desired in the production of a high grade starter. Somewhat lower temperatures might be used without any noticeable change in results, but a much lower temperature should be avoided. This temperature brings about a fairly rapid coagulation of the starter, and investigators have found that rapidly coagulated starters were better than those which coagulated slowly. This advantage may be due to the greater tendency of rapid acid development to restrain undesirable organisms.

Quantity of Starter for Inoculation Purposes.

The rate of coagulation of the starter is not greatly affected by the amount of starter added for inoculation purposes; that is, a light inoculation of the milk for the production of a starter sometimes coagulates quicker than a heavy inoculation, while at other times the reverse occurs.

MILK FOR CHEESE MAKING.

For cheese making, the milk supply should be graded, and the grading checked by the use of the methylene blue test and the Wisconsin curd test in conjunction. In this way, exact information as to the quality of the milk of each supplier at every delivery is obtained. It also stimulates the interest of suppliers in the manufacturing processes.

Suppliers should always be informed of the results of factory tests, for improvement in the quality of milk is primarily an educational matter. The sources, development, and control of bacteria in milk should be discussed with them. While daily deliveries of high grade milk are usual, it must be remembered that from time to time milk of a lower quality is delivered from the same farms. The bacterial count in the poorer milk is often so high as to effect seriously the whole of the day's supplies

to the factory with which it is mixed. The fact that most of the milk delivered is high grade shows that there is no reason why every gallon sent in should not be of the same quality.

It is obviously quite unfair to penalise one's more efficient neighbour by supplying milk of a lower quality, which on being mixed with the whole supply must bring the general average of quality down. In the language of the bush it is nothing more or less than "polling on your mate," a social sin which even the best of us finds it hard to tolerate.

What one farmer can do in the same locality and under the same conditions, the other farmer can do, so there should be no excuse really for sending second rate milk to the cheese factory. If, however, in spite of whatever care is taken to keep supplies up to the required standard, no improvement is apparent, the suppliers concerned should be encouraged to discuss their individual problems and methods of milk production and handling, and so help to clear up any difficulties or doubts they may have. If any improvement in the supply results from investigation or advice, the farmer concerned ought to be told about it strightaway. If on the other hand, low quality persists in a particular supply, the producer should be made aware of the facts, in a frank and friendly way, so that they may be grasped readily and appreciated.

Mere fault-finding is useless as well as exasperating. If an investigation is necessary, let it be a friendly investigation. The work, after all, is educational; it becomes a check on supplies and factory processes through which the faults, whether on the farm or in the factory, may be corrected.

To maintain an efficient check on the quality of supplies, all milk should be sampled immediately on delivery each day. To sample milk one day and neglect it the next is anything but satisfactory, for variable conditions make it impossible to interpret the results correctly. Climatic changes, for instance, influence directly bacterial counts.

When all is said and done, the thing that matters most is the financial return. Show the supplier that a high grade product puts more money into his pocket, and he will work overtime in finding and remedying the faults that reduce his income.

MINERAL DEFICIENCY IN DAIRY STOCK.

MEDICAL men, research workers, and other interested people have during the past ten to twenty years realised that many abnormal and diseased conditions are connected with or due to deficiencies in the food supplied to stock, and that some of these diseases may be traced to the absence of the proper quantity of mineral substances in the soils in which the grass and crops are grown.

Considerable research on the subject by Sir Arnold Theiler, South Africa, Orr, of the Royal Institute at Reading, England, Eccles in America, and Henry and Brünnich in Australia, has demonstrated definitely that soil and pasture are the keys to normal health in stock.

Mineral deficiency in soil and pastures is of particular interest to stockowners in this State, for upwards of 70 per cent. of the products of the State are derived from our native pastures.

One of the most demonstrable deficiency diseases in humans is to be found in the case of those associated with iodine deficiency. This is often reflected in the enlargement of the thyroid glands producing what is known as goitre. The thyroid glands are situated on either side of the windpipe and these store and distribute the supply of iodine to the body. This deficiency in iodine supply not only produces goitre but affects also the functioning of other glands, resulting in abnormalities in growth both physical and mental. In countries such as Switzerland, where the drinking water supply is obtained from melted snow, the result of iodine deficiency is most marked. In Switzerland, for instance, there are said to be over 50,000 imbecile dwarfs. It has been found, however, that where iodised salt is fed, the condition can be prevented and normal development in body and mind continued. In such countries it is usual also to sell iodised sweets, as lollies provide a good medium through which to supply the iodine to children.

Stock are affected very considerably through such a deficiency, which is, of course, more marked in certain parts of the world. In British Columbia (America), for instance, where there is a marked deficiency in iodine, investigations revealed that it was the cause of heavy mortality in calves and pigs through abnormal births.

Recent investigations, however, indicate that it is doubtful whether there is any marked iodine deficiency in Australia. But iodine deficiency is only one direction from which trouble may arise. In different portions of the State we

find cows often passing away an idle hour chewing bones or rags, licking clay deposits, or even finding solace in a stone. This is an instinctive endeavour on the part of the cow to supply herself with some mineral that is deficient in her food, and phosphorus and calcium are the two most common elements that are lacking.

Lime is an important factor in controlling the clotting of the blood, regulating the heart's action, determining the firmness of muscle, assisting the digestion of fat, and in controlling the action of other minerals on the body. Phosphorus is essential for the building up of all tissues of the body, and without it the supply of milk and flesh would be impossible. These two minerals enter very largely into the composition of bones, and, consequently, young animals developing their skeletons or cows in calf require comparatively greater amounts of these minerals.

Mineral Content of Milk.

It must also be remembered, apart from body requirements, there are seven pounds of mineral matter in 1,000 lb. of milk, and as a heavy-producing animal yields her own weight in milk each month, it is essential that she be supplied with an adequate mineral ration to remain in normal health and maintain production to her capacity.

Mineral-Deficient Soils.

The area of mineral-deficient lands within the State is not definitely known, but it is known that the greater part of the coastal area falls within this category. Comprised in this area, however, are portions of normal mineral content, such as where basaltic outcrops occur, and on the alluvial soils of river flats.

It is in these deficient areas where osteophagia (bone-chewing) and osteo-malacia (bone disease) occur. This abnormal condition in cattle has been noticed in inland country. In the Charters Towers area, investigations are at present being carried out by the Council for Scientific and Industrial Research in regard to a deficiency disease referred to locally as "pegleg."

In South Africa, where phosphorus deficiency is a general characteristic of the soils, investigatory work was carried out some years ago into diseases known by the Dutch names of "Stijfziekte" (Stiff-sickness) and "Lamziekte" (Lame-sickness), which were the cause of heavy losses in stock through abnormal growth and mortality. It was at that time determined that these diseases were the indirect consequence of phosphorus deficiency.

It is impossible for any animal on a diet poor in essential minerals to make normal growth or be capable of normal production. The deficiency is thus the cause of ill-health, which may vary in degree from a hardly noticeable lack of the bloom which is characteristic of an animal in proper health to a state like rickets, where it can be obviously diagnosed a disease. Generally it is evidenced in unthriftiness, bone abnormalities, lameness, broken bones, depraved appetite, decreased milk yields and breeding difficulties.

Unfortunately, it is only when the trouble is more or less in an acute form that it is noticeable to the untrained eye, with the result that there are thousands of cattle suffering from malnutrition due to mineral deficiency quite unknown to their owners. The direct economic loss to dairy farmers so situated must be enormous.

If mineral deficiency is suspected on a farm—and this will apply to most of our coastal farms—measures should be taken immediately to remedy it. Obviously the natural method is to ensure that the pastures are not deficient, but as this entails top-dressing the method is too costly to be essentially practicable. It is preferable to supplement the food supply by substances containing the necessary minerals.

A Mineral Mixture for Stock.

In this State it is recommended that a mixture of two parts of finely ground sterilised bonemeal, one part of common salt, and a small amount of potassium iodide, 1 or 2 oz. to 1 cwt. of lick mixture, be supplied to dairy cattle. This mixture supplies lime, phosphorus, and iodine, while the salt has a beneficial action on the digestive system. Nauru or Ocean Island phosphate may be substituted for sterilised bonemeal if the latter is not procurable. This lick mixture may be fed at the rate of 2 oz. to 4 oz. per day, but it is preferable to place the lick in a suitable position and allow the animals to partake of it as required. Hand-fed cows in profit can be allowed 2 oz. per day in 1 lb. bran during milking in the shed. The ration could be placed in a small box at the head of the bail to be licked up by the cow.

Much research work remains to be done in respect to deficiency diseases; in fact, it may be said that only the fringe of the subject has been touched. The coming years will undoubtedly see great progress made in this work, both in the veterinary and medical fields.

THE QUEENSLAND PIG INDUSTRY ACT OF 1933.

THIS Act aims at effecting immediate and very definite improvement in the systems under which pigs are bred, fed, managed, and marketed. It aims primarily at the production of healthy, well-developed stock for the local, interstate, and overseas trade, under conditions conducive to greater efficiency and enhanced returns to the producer.

Incidence of Disease.

The pig population of Queensland is approximately 250,000 or one-fifth of the total number in the Commonwealth. A very conservative estimate of present mortality in young pigs—i.e., pigs under 6 months of age—would state the figure at 25 per cent., or a loss each year due to specific and nutritional diseases of some 62,500 young pigs, which might readily be stated as carrying a nominal value of £1 per head. Condemnation of pig carcasses on slaughter for tuberculosis and other preventable diseases total approximately 1.14 per cent. Thus, 4,500 pigs are condemned annually which would carry a market value of 50s. per head, or a total sale value of £10,000. Condemnation of pig heads affected with tuberculosis, abscesses, &c., total 4.38 per cent., while the losses from bruising and damage, improper castration, and from other causes are very heavy.

Industry Losses.

In round figures, therefore, it might be said that the losses from preventable diseases in the pig industry total very close to £100,000 per annum—a condition of affairs which calls for very urgent and definite action on the part of the Government, hence the legislation aiming at reduction in the incidence of disease, and greater efficiency in the industry.

General Improvement in Sanitation and Hygiene.

The Act provides for a general improvement in the conditions under which pigs must be kept on farms. It prescribes in sections 5, 6, 7, 8, and 9 that piggeries shall be kept in a clean and wholesome condition and subject to the control of departmental inspectors. As is well known, there is a tendency on many farms to treat the pigs as scavengers and to permit them to be kept under insanitary conditions—conditions favourable to the development of disease.

It is the desire of those responsible for framing the Act to very definitely assist producers who are sufficiently well informed to understand and practice sanitation, and to keep their pigs under healthy conditions. Similarly, it is intended to extend the instructional campaign so that there will be no necessity to penalise farmers, except in cases of refusal to observe the ordinary rules of health and to co-operate with the Department in a clean-up campaign.

Section 5, in addition to providing for immediate improvement in the conditions under which pigs are kept and fed, definitely provides the inspector with much-needed powers to have improvements effected, a power which, in the past, in the absence of disease, inspectors have not possessed.

Provision for notification of disease is essential, especially in cases of infectious and contagious diseases which, in themselves, are responsible each year for a great deal of loss. It is not claimed that Acts like the Diseases in Stock Acts are defective, but rather that with the extension of pig-raising activities it becomes essential to concentrate and to have included under one Act the numerous clauses referring to pigs that are now scattered through several Acts.

Marketing—Sales, Grading, &c.

The basis of the clauses in marketing sections, 10, 11, 12, 13, 14, 15, have been subjects of discussion at numerous meetings of committees of the Queensland Pig Industry Council, and have also been under notice of the Queensland Meat Industry Board and of pork exporters and embody the general desire of trade interests. To encourage the farmer to improve his stock and his piggeries he needs to be paid more on a quality than on a weight basis for the pigs he markets, hence the inclusion of a section to provide for grading of pigs and of carcasses by officers who have the certificate of efficiency conferred on those who qualify by examination as pork and bacon graders.

Section 10 requires that, where pigs are purchased over the scale by a representative of any factory, such representative shall place on such pigs a sufficient mark to ensure identification of the vendor in order that it will be possible more readily to trace disease to the source of origin. Some difficulty arises by reason of the different conditions under which pigs are purchased by proprietary and co-operative factories, but it is believed that the clauses 11 and 12 will give ample scope for the protection of farmers and of business firms, for the farmer is not the only one that suffers as a result of disease and mortality in his herd, or heavy losses for condemnations.

Provision has, however, been made for the net proceeds from the sale of any by-products obtained from a pig, the whole or part of the carcass of which has been condemned, to be paid to the vendor.

Provision has been made for examination of the quality of carcass pork, or bacon sides or parts thereof, and if necessary for a stamp indicating the quality on such goods. This is a clause designed entirely in the interests of producers and consumers.

Regulations.

Regulations under this Act are now being drawn up and it is expected that the Act will be in operation early this year.

QUEENSLAND SHOW DATES, 1934.

Stanthorpe: 7th and 9th February.
Killarney: 16th and 17th February.
Allora: 7th and 8th March.
Clifton: 14th and 15th March.
Tara: 21st March.
Milmerran: 20th March.
Goombungee: 28th March.
Pittsworth: 4th and 5th April.
Warwick: 10th and 12th April.
Toowoomba: 16th and 19th April.
Rosewood Camp Draft: 7th April.
Oakey: 28th April.
Taroom Camp Draft: 30th April.
Taroom: 1st and 2nd May (Rodeo, 5th May).
Dalby: 2nd and 3rd May.
Beaudesert: 2nd and 3rd May.
Charleville: 8th and 10th May.
Nanango: 3rd and 4th May.
Blackall: 7th and 9th May.
Chinchilla: 8th and 9th May.
Crow's Nest: 9th and 10th May.
Boonah: 9th and 10th May.
Monto: 9th and 10th May.
Kingaroy: 10th and 11th May.
Ipswich: 15th to 18th May.
Mitchell: 16th and 17th May.
Wondai: 17th and 18th May.
Roma: 22nd to 24th May.
Gympie: 23rd and 24th May.
Kalbar: 26th May.
Goomeri: 29th and 30th May.
Wallumbilla: 30th and 31st May.
Maryborough: 1st, 2nd, and 4th June.
Childers: 5th and 6th June.
Marburg: 1st and 2nd June.
Bundaberg: 7th to 9th June.
Lowood: 8th and 9th June.
Rockhampton: 19th to 23rd June.
Mackay: 26th to 28th June.
Laidley: 27th and 28th June.
Townsville Rodeo: 30th June.
Bowen: 4th and 5th July.
Gatton: 4th and 5th July.
Kilcoy: 5th and 6th July.
Townsville: 10th to 12th July.
Woodford: 12th and 13th July.
Rosewood: 13th and 14th July.
Cleveland: 13th and 14th July.
Cairns: 17th to 19th July.
Charters Towers: 18th and 19th July.
Caboolture: 20th July.
Nambour: 18th and 19th July.
Pine Rivers: 27th and 28th July.
Royal National: 6th to 11th August.
Imbil: 7th and 8th September.
Beenleigh: 20th and 21st September.
Malanda: 26th and 27th September.
Kenilworth: 29th September.

HOW TO MAKE A ROPE PIG-NET.

E. J. SHELTON, H.D.A., Instructor in Pig Raising.

IN the transport of pigs to rail, sale, show, or market, per wagon, truck, cart, or other open conveyance, some form of net or cover is required to prevent the pigs escaping and to protect them from injury or mishap. The rope pig-net illustrated and described in this article is the type usually recommended for the purpose, for it has the advantage of being simple in structure, easily contrived by the handy man, and is inexpensive, withal durable and convenient.

It is worthy of mention, however, that it is not a sunshade and will not protect the pigs from the blistering effects of the sun when they are exposed to its direct rays as they frequently are when removed from cool protected sties and placed in the cart or wagon for transport by road to the township or trucking station. This suggests the necessity of providing some form of shade or protection, even if it is only a few green bushes or a wet bag or two.

It is important that bacon pigs en route to the factories, and store or pork pigs en route to sales, &c., should be thus protected in order that they will arrive at destination in good order and condition, and, in the case of the bacon factory, free from sunburn or sunscald or other ill-effect.

The method of procedure in the making of a pig-net such as is illustrated herewith is extremely simple, and should be readily understood by all concerned. The materials required are rope and a length of softwood or hardwood board rounded at the edges and 12 to 18 inches long and of the same width at both ends. This piece of board is referred to by net-makers as the mesh stick, its principal use being to keep all the meshes the same size. In actual use a mesh stick 2 inches wide will make a 4-inch mesh; a 3-inch stick a 6-inch mesh, &c. The objective is to have the stick half the width of the mesh it is intended the net shall carry.

In measuring the meshes it is necessary to draw them out to a diamond shape. The 4-inch mesh is preferable for bacon or pork pigs, a smaller mesh for suckers and weaners. Where fishermen set out to fashion a fishing net they use a long needle and the cord is held on a reel or short length of timber, but in the case of a pig-net the rope had better first be rolled up in the same way as the ordinary rope clothes-line or sash cord is when purchased; it will then be a simple matter to pass the hank of rope through the loops when making the knots at the corner of each mesh, for the knotting is rapidly performed by an experienced worker.

The Method.

In setting out to make the net, first tie a loop in one end of the rope as in A, Figure 1. Place this knot on a strong spike or hook attached to a post or wall or some other convenient place as at A in Figure 2. Now place the mesh stick under the loop as at B, put the rope around the mesh stick, then pass the rope through the loop and pull rope tight, proceeding to place the thumb of the left hand on the rope beyond the loop as at A in Figure 3, and with a turn of the wrist of the right hand throw the rope to the position shown at B. Next pass the rope behind the loop C, and then through the bight of B and down as at D; draw knot tight, which should now assume the shape indicated in Figure 4. This figure shows the knot made loosely to enable the method of making it to be clearly seen and readily understood. The rope must be held firmly with the thumb at A, Figure 3, when pulling up the knot, as on this depends the uniformity of the shape and size of mesh.

To continue the netting, the stick is withdrawn and placed under A, Figure 4. The rope is then passed around the stick as in Figure 2 and brought through the loop A, Figure 4, and the process shown in Figure 3 is repeated to form another mesh, this being continued to make a chain of meshes, say, the width of the conveyance to be used when transporting the pigs to rail or sale. The loop A, Figures 1, 2, and 5, first tied is then untied and it will be found that all the meshes are equal in size. Next the chain of meshes is opened out at right angles to the line in which it was made, as shown in Figure 6; in other words, remove the chain of meshes from a vertical position as in Figure 5 and place them in a horizontal position as in Figure 6. A line is run through the meshes D, E, F, G, and secured between two posts to hold the net while continuing the meshing. Working across is then begun by making a mesh at A, Figure 6, then at B, C, and so on until the length of the first lot of meshes has been reached, when the right-hand side of the net is turned around and placed where the left-hand side was and the left-hand side placed where the right-hand side was. Another row of meshes is started on the left-hand side (facing the net) and worked until the one under A has been reached on the right-hand side.

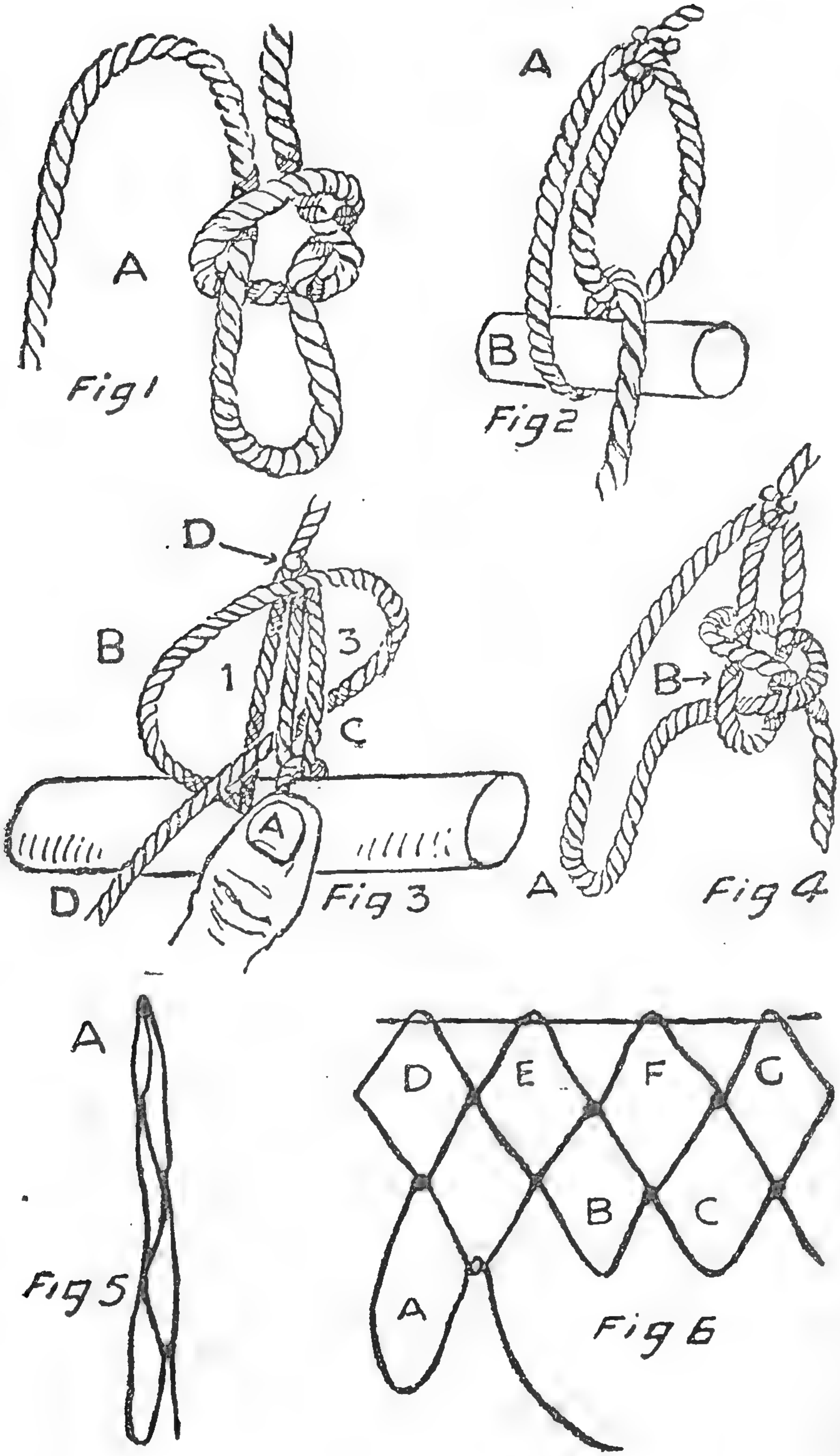

Plate 21.

The net is turned again, and another row of meshes commenced on the left-hand side, and so on until there are enough rows of meshes to cover the vehicle. To secure the net to the vehicle use rope plough lines, and reeve them through each mesh and around the side and end rails of the body of cart. The method described herein of making the meshes is the same as is used in making ordinary hammocks.

Rope pig-nets may be purchased at most country stores, or if not on hand could readily be ordered, but it is neither an expensive or difficult task working one up, and from the instructions given above and illustrated any handy person should be able to complete the job. If wet bags are being used as a cover when the pigs are loaded, tie the bags to the net at each corner of bag; this will save inconvenience and loss, and will be more satisfactory.

It is preferable that the net and bags should be at least twelve inches above the backs of the pigs, otherwise the net is inclined to rub and injure the flesh and blister the skin. Every possible care and attention should be given to see that this does not happen, hence it is desirable that the net be made six or more inches wider than the vehicle on which it is to be used.

In loading secure the net on both sides and in front, first leaving a good length of plough rein free to tie the net to rail of tailboard when pigs are loaded and vehicle is free from loading race.

PLATE 22.

A deep, rock-walled ravine in the Carnarvon Range, a "newly-discovered" scenic region in Queensland's Middle West remarkable for its wild beauty, and abounding in native game.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Friesian Cattle Club, production charts for which were compiled for the month of November, 1933 (273 days period unless otherwise stated):—

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORNS.			
	MATURE COWS (OVER 5 YEARS), STANDARD 350 LB.			
Gentle 2nd of Blacklands (365 days)	H. D. Giles, Biggenden	11,210	504·095	Sir Hugh of Hillview
Primrose of Trevor Hill	G. Gwynne, Umbiram	11,045·6	448·973	Prince of Braemar
Carnation of Trevor Hill	A. E. Vohland	10,492·8	429·362	Prince of Braemar
Betty of Lyndith	S. H. Teese, Veresdale	11,731·06	423·001	Karl of Ashbourne
Bluebell 3rd of Happy Valley	R. R. Radel, Coalstoun Lakes	8,266·95	370·914	Chief of Hillview
	JUNIOR, 4 YEARS OLD (UNDER 4½ YEARS), STANDARD 310 LB.			
Velvet of Trevor Hill	G. Gwynne, Umbiram	8,585·1	369·427	Prince of Braemar
Voco of Wilga Vale	C. O'Sullivan, Ascot, Greenmount	8,968·15	349·535	Reliance of Blacklands
Violet of Trevor Hill (269 days)	G. Gwynne, Umbiram	9,191·2	347·288	Prince of Braemar
	SENIOR, 3 YEARS OLD (OVER 3½ YEARS), STANDARD 290 LB.			
Navilus Vera	C. O'Sullivan, Greenmount	11,038·69	392·95	Charmer of Glenleigh
	JUNIOR, 3 YEARS OLD (UNDER 3½ YEARS), STANDARD 270 LB.			
Kyabram Marie	A. H. E. Black, Kumbia	9,424·65	374·976	Ledger of Greyleigh
	SENIOR, 2 YEARS OLD (OVER 2½ YEARS), STANDARD 250 LB.			
Navillus Olive	C. O'Sullivan, Greenmount	9,249·5	365·816	Midgets Shiek of Westbrook
Rosemount Doreen 18th	P. D. Frechtner, *via* Greenmount	8,046·08	341·953	Bright Star of Cosey Camp
Millstream Molly	W. J. Barnes, Cedar Grove	8,041	323·335	Magnet of Kurrawong
Rosehill Dahlia	W. Flesser, Boyland	7,278·63	312·84	Philiquil of Oakvale
Kingsdale Bella	A. A. King, Mooloolah	6,801	285·761	Diamond Boy of Burradale

JUNIOR, 2 YEARS OLD (UNDER 2½ YEARS), STANDARD 230 LB.				
Lyndith Primrose	S. H. Teese, Veresdale	6,270·12	245·374	Brooklyn Terrace President
Euroa Rosebud	H. L. Lindenmayer, Mundubbera	5,991·5	239·214	Swagman of Clonagan
FRIESIAN.				
SENIOR, 2 YEARS OLD (OVER 2½ YEARS), STANDARD 270 LB.				
Oaklands Stella Rock 4th	W. Richters, Tingoora	8,207·74	310·644	Pied Rock
JERSEY.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Seycombe Glory's Garland	C. T. Seymour, Coalstoun Lakes	7,985·6	453·643	Carnation Royal
Seycombe Golden Peach	C. T. Seymour, Coalstoun Lakes	6,282·05	371·592	Carnation Royal
Seycombe Genuine Gold	C. T. Seymour, Coalstoun Lakes	5,945·75	356·856	Carnation Royal
Seycombe Myrtle	C. T. Seymour, Coalstoun Lakes	5,932·6	354·537	Carnation Royal
Seycombe Golden Glimmer	C. T. Seymour, Coalstoun Lakes	6,093·05	353·711	Carnation Royal
JUNIOR, 2 YEARS OLD (UNDER 2½ YEARS), STANDARD 230 LB.				
Glenview Larkspur	F. P. Fowler and Sons, Coalstoun Lakes	4,448·25	267·765	Carlyle Larkspur 2nd Empire
Glenview Milkmaid	F. P. Fowler and Sons, Coalstoun Lakes	4,226·8	266·025	Carlyle Larkspur 2nd Empire

Answers to Correspondents.

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. Cyril T. White, F.L.S.

Wild Millet.

J. B. (Marbango, Western Line)—

The specimen is *Echinochloa crus-galli*, commonly known as Wild Millet. It is a good grass, very closely allied to the well-known fodders White Panicum and Japanese Millet, of which it is supposed to be one of the wild parents. It is widely spread over the warmer regions of the world, and several forms of it occur wild in Queensland. Seed of it is not stocked, so far as we know, by nurserymen, and if you wished to propagate the grass you would have to keep seed from your own plants.

Hop Clover.

G.B. (Gympie)—

The specimen is *Trifolium procumbens*, the Hop Clover, a native of Europe, now widely spread over most warm temperate countries. It is very common in parts of Australia, especially in the Southern States. In Queensland it makes its appearance in the winter months, seeds in the early summer, and dies off on the approach of the real hot weather. It is an annual clover not stocked by seedsmen, but once it establishes itself it generally comes back each year from self-sown seed. Like most of the annual clovers, it makes good feed during the spring and late winter months when often other feed is not available. This year has been an exceptionally good year for clovers and trefoils.

Fuchsia Bush.

J.H.C. (Charleville)—

We know that trouble has been experienced on several occasions on the Quilpie Trucking Reserve, and think that Fuchsia Bush is the cause. Fuchsia Bush is plentiful on the town common, and when eaten by travelling stock, particularly on an empty stomach, no doubt this plant, like others containing a prussic acid-yielding glucoside, causes severe mortality. Many of these prussic acid-yielding plants are eaten by ordinary browsing or paddock stock apparently without any ill-effects following. The mere fact that the town cows and the general grazing stock in the neighbourhood of Quilpie feed on the common, particularly on the Fuchsia Bush, without any ill-effects following is no indication whatever of the plant's effect on travelling stock.

These plants are not common agricultural weeds, and no special means of eradication are known, other, of course, than grubbing-out. If desired, the plants could be sprayed with a weak arsenical solution, but the use of arsenical sprays is exceedingly dangerous where stock are running. A spray such as "Weedex," containing calcium chlorate, could be tried at about 5 per cent. solution. This weed spray is not known to be poisonous to live stock in a diluted form, but its efficacy in destroying hard woody plants such as those you send has not been tried out.

Candle Nut.

W.J.M. (Tirroan)—

The nuts forwarded with your letter of 13th November represent the Candle Nut, *Aleurites moluccana*. The name "Candle Nut" arises from the fact that the seeds are very oily and in certain parts of the South Sea Islands, particularly in the New Hebrides, they are strung together and burnt in the form of a candle. They burn with a fair flame and a great deal of smoke. The tree is a native of North Queensland, but is also spread over the Malayan Archipelago and the islands of the Pacific. The majority of people seem to eat the nuts with impunity, but occasionally one hears of cases of people being made violently ill through eating the nuts. Probably if the oil has turned the slightest bit rancid the nuts are dangerous, causing severe vomiting and diarrhœa.

Australian Centaury; Groundsel; Blue Panic; Giant Couch.

H.R. (Cooroy)—

The specimen is *Erythræa australis,* the Australian Centaury. This is a fairly common weed in paddocks in the coastal parts of the State from the Tweed to Wide Bay. The plant is not known to possess any harmful properties. It is, in fact, collected by some people and used as a tonic, the English Centaury being supposed to have considerable value in this respect.

The other specimen you forwarded under the name of Saltbush is the Groundsel Bush, *Baccharis halimifolia,* a native of South America, now a great pest on the North Coast line, particularly on the low-lying swampy country. Cattle eat this bush when hard pressed, but it has no fodder value. It has been suspected of possessing poisonous properties, but feeding tests carried out at Yeerongpilly some few years ago showed the plant to be harmless, though almost destitute of any nutritive value.

Regarding Blue Panic, *Panicum antidotale,* we should say the best time to plant this would be during the spring or summer. The present time future of *Panicum antidotale* will be more or less as a cultivated grass is excellent. As you say, root-planting is tiresome, though we think the in small paddocks of two to five acres as a standby for raising in the same way as an ordinary cultivated crop.

Have you tried *Brachiaria mutica,* better known as *Panicum muticum* or Giant Couch? This should be an excellent grass for some of the country about Cooroy. It is a tropical grass, and in the southern parts of the State is probably best handled in small paddocks for grazing purposes. We recently saw a small cultivated plot of it near Coolum, and were informed by the owner of the property that, when cultivated, this grass would carry up to three and four beasts per acre.

Gardenia Ochreata; Cocksburr Thistle.

O.L.H. (Mareeba)—The specimens forwarded with your letter of 17th November have been determined as follow:—

The tree from Mount Garnet is *Gardenia ochreata,* a small tree or large shrub of the family Rubiaceæ. It is fairly common in North Queensland but we have not heard a local name given to it. It bears a fair-sized fruit, but we do not think this is edible, though it is not known to be poisonous in any way. If desired to propagate the tree it should be easily propagated from seeds.

The weed from the farm at Kairi is *Centauria melitensis,* Cocksburr Thistle, or Saucy Jack, a native of Southern Europe, now a naturalised weed in most warm temperate countries. It is an exceptionally bad weed in New South Wales and in parts of South Australia. In Queensland it is very common on the Darling Downs, but is less abundant in more coastal localities. When quite young it is eaten by stock, but soon becomes harsh and unpalatable.

Derris; Pyrethrum.

K.A.E. (Landsborough)—

We have three native species of *Derris* in Queensland, which have all been tested as insecticides. The best is *Derris trifoliata,* common in the north-eastern parts of the State, particularly from Mackay northwards. It also occurs in New Guinea and the islands of the Pacific, where it is known as Dynamite Plant on account of the custom of the natives of chopping up parts of the stem and throwing them in water to stupefy fish.

Regarding *Pyrethrum roseum,* the Department imported seeds of *Prethrum* some time ago and distributed them to several parts of the country. We should think as far as cultivation is concerned *Derris* would have more possibilities in Queensland than *Pyrethrum,* because the Japanese, we understand, flood the market with *Pyrethrum* at a very low price.

Mossman Grass.

J.J. (Marlborough)—

The specimen is *Cenchrus echinatus,* a grass that is said to be a native of tropical America, but is now widely spread over most tropical countries. In Queensland it is most abundant in the north-eastern parts of the State. It is a bad burr grass, and, we should say, would have little value as a fodder. In North Queensland it is commonly known as Mossman Grass or Mossman River Grass.

Cotton.

J. INMAN (Goodenough Island)—

The Director of Cotton Culture, Mr. W. G. Wells, advises:—The sample of cotton submitted is probably a descendant of the old Caravonica variety. Sample rather weak for this type, variable in length, ranging from 1 1/16 in. to 1¼ in. Difficult to estimate value, owing to limited demand for this type of cotton.

Black Bean or Moreton Bay Chestnut.

C.F.F. (Kairi)—

The specimen is the seed of *Castanospermum australe*, the Black Bean or Moreton Bay Chestnut. The seed, when eaten by cattle, causes severe gastro-enteritis, sometimes resulting in death.

C.B.P. (Barcaldine)—

The specimen bore neither flowers nor seed pods, but we should say it represents the rather young growth of the Rubber Vine, *Cryptostegia grandiflora*, a shrub or vine that is cultivated in Northern and Central Queensland as an ornamental plant. In some places it has run out and become more or less of a pest. No feeding tests have been made with the plant, but it belongs to a dangerous family. If the calf had been feeding on the plant we think it is most likely the cause of the trouble.

Method of Polishing Bullock Horns.

N.L.P. (Jambin, Callide Valley)—

The Senior Instructor in Pig Raising, Mr. E. J. Shelton, has kindly supplied the following information:—

Method 1.—To polish bullock horns, first soak them in warm water until the core can be removed. Smooth by rasping, scraping with the edge of glass and sand paper, using fine emery paper last; then rub with a cloth moistened with linseed oil dipped in emery powder, finally rubbing and polishing with the hands. They may be more readily handled by tapping in a piece of wood and holding in a vice.

Method 2.—Scrape well with glass and afterwards rub with finest glass paper; then with powdered bath brick and oil, and finally with rotten stone and flannel or felt. Scrape with glass to remove any roughness; then grind some pumicestone to powder or buy it in powdered form, and with a piece of cloth wetted and dipped in the powder rub them until a smooth face is obtained. Next polish with rotten stone and linseed oil and finish with dry flour or a clean piece of linen.

Method 3.—Rasp them to take the outside rough shell off, then scrape well till the colour shows up, using rough sandpaper; then scrape and finish with a fine piece of glass. For polishing use vinegar and whiting and finsh with a piece of silk.

Another method is, after taking off all rough surfaces, to fill the horns with kerosene till it penetrates through. Pour out then and polish with oxide of tin and rub with a kerosene rag till all scratches are out. Then with a little dry powder on finish off with friction with a soft hand or piece of silk. Any of the ingredients mentioned above can be purchased through local stores in the country or at city stores.

Tanning Wallaby Skins.

N.L.P. (Jambin)—

The length of time it takes to tan a wallaby skin by the brigalow-bark process would depend entirely on the strength of the tan liquor used and the size of the skin. Brigalow bark is rarely if ever used in commercial tanning, the wattle bark method being considered superior in every way; in New South Wales oak bark is mostly used as an alternative to wattle bark where the latter is not available, and takes about the same time.

Some tanners consider brigalow bark tanning only suitable for hard leather like sole leather, and not as suitable a bark as wattle bark for marsupial skins.

Blue gum bark is also to be preferred, although it is a slower process.

Time taken always depends on the thickness and size of the skin, but it is usually from two to four weeks, and if fur is left on they only tan from one side through the pelt. It is suggested as a wise procedure to cut off a small portion to try the tan and time taken. If any white patches are observed the skin is not properly tanned and will be soft and will not keep well.

Plant Affecting Pigs (*Teucrium argutum*).

G.B. (Gympie)—

The specimen is not the plant familiarly known as Wild Mint, which has come into prominence so much of recent years as the probable cause of losses in stock on the Darling Downs. It belongs to the same family, however. It is *Teucrium argutum*, a plant for which we have not heard a common name. It is seen in pastures, also in cultivation. It develops large white underground runners. These, when turned up by the plough, are greedily sought after by pigs. It sends them into a very excited state and they rush madly about. They recover after a short time.

Sudan Grass, Its Poisonous Properties; *Paspalum Urvillei*.

A.L. (Ipswich)—

In reply to your inquiry about the poisonous properties of Soudan grass, the Agricultural Chemist advises that fatalities with Soudan grass are very rare. As a rule grazing on this grass is fairly safe. Experience shows that the poisonous principle when it develops is most likely to occur in the very young growth stages. The poisonous principle is much more rare in Soudan grass than in the common Sorghum.

The sample of grass you send is *Paspalum Urvillei*. This is closely allied to the common *Paspalum*, but is inferior to it in palatability and nutritive properties.

PIG RAISING.

Replies selected from the outgoing mail of the Senior Instructor in Pig Raising, Mr. E. J. Shelton.

Spots on Large Whites—Crown on Rump.

R.A.S. (Abercorn)—

(1) With regard to blue spots or freckles on the skin of Large White pigs, it is apparent that this objectionable feature appears in the White breeds the world over and is one of the faults to be guarded against. The standard of excellence printed on page 56 of the current issue of "The Australian Stud Pig Herd Book," states, in regard to colour, skin, and hair—

> "Hair white, free from black hair, and as far as possible free from blue spots on the skin; skin fine and free from wrinkles; hair long and moderately fine—10 points."

It is apparent from this that blue spots on the skin would not debar an animal from competition, but of course it is quite possible and more than likely that a judge would eliminate animals showing more than one or two blue spots. Strangely enough, these blue spots usually occur just above the eyes and under the ears, though why this should be is difficult to explain. We have always regarded spots on any other part of the body as more objectionable than spots above the eyes, and we know other judges who do the same. Quite recently, in an inspection of a litter of Large Whites, several pigs were noticed with probably twenty blue spots distributed over the rump and loins, and it would not be difficult to understand in this case that these animals would be debarred from competition; nor should they be used as breeders on account of risk of transmission.

(2) *Crown on the Rump.*—The following may be regarded as distinctly objectionable features in Large White pigs:—Black hairs, black spots, a curly coat, a coarse mane, short snout, inbent knees, hollowness at back of shoulders; in fact a few years ago these objections were published with the standard of excellence. A crown or swirl or cowlick on the hair of rump or back is, in our opinion, very objectionable from a show point of view, although there are no instructions in the herd book that they are to be regarded as such. Like the blue spots, there is always the risk of transmission of these faults to the progeny, and as the "very best" only should be used as breeders animals with faults like this should be culled. They could be used for crossbreeding. We are also of opinion that, if a stud breeder sells faulty animals as stud stock he is not keeping faith with the Society, which trusts breeders of stud pigs to sell none but the best approved animals, and on that account does not pay inspectors.

The better marked animals are always worth a guinea or two more than mismarked stock, and it is up to breeders to sell the very best.

The Pig's Diet.

M.A.B. (Yelarbon)—

The Director of the Animal Health Station will advise you fully in regard to the health of your pigs, but, dealing with the question from a dietetic point of view, the trouble appears to be due to the feeding of indigestible fibrous matter leading to constipation and general digestive disorders. These chronic troubles weaken the animals to such an extent that paralysis sets in and they are then prone to develop other nervous and constitutional troubles, and perhaps to suffer severely from the effects of stomach and intestinal worms and possibly from bush tick poisoning—also a common cause of paralysis in young pigs.

You state that the pigs are nine months old and are only in forward store condition. This indicates a serious lack of knowledge in the feeding and care of pigs, for pigs should be marketed as prime baconers before they are six months old if they are to be profitable, and as heavy baconers before seven months of age, and at that age probably they would be too heavy for best market requirements.

Perhaps they are slow-growing because they are not properly fed or, may be, it is their breeding, care, and attention that is at fault, just as much as their feeding. It may so happen that they have been fed on decaying curd or the thick dry curd that forms on the sides of milk vats, &c., and that loosens during wet weather, and in falling into the food contaminates it to such an extent as to make it poisonous (protein poisoning); or it may so happen that the pigs may have died of heatstroke caused by exposure to the sun and by lack of sufficient drinking water. These are all possible causes, and in the absence of inspection you will realise it is difficult to locate the exact cause. The district Stock or Dairy Inspector would advise you in your difficulty.

Change the pig's food—add tablespoonful doses of cod liver oil to those that are sickly. Keep the bowels open by repeated doses of epsom salts and the use of plenty of green lucerne or other green food, and compel the pigs to take regular daily exercise in a clean grassy paddock.

DAIRYING.

Lime in Calf-feeding.

A.B. (Nanango).—The Supervisor of Dairying, Mr. Chas. McGrath, advises as follows:—

Lime is a necessary constituent for all classes of domestic animals. The addition of lime to the milk fed to calves is recommended. It renders the curd portion of the milk more readily digestible and acts in correcting acidity in the stomach, and adds to the supply of lime for bone formation.

Lime water can be conveniently made available on the dairy farm. Water will dissolve only a definite amount of lime, 10 grains to a pint.

To prepare a stock of lime water add about 20 lb. lime to 10 gallons of water in a wooden barrel, and stir thoroughly. Then allow to settle. Smaller quantities could be prepared in earthenware or glass containers. The clear liquid present on settling is a strong (concentrated) lime solution ready for use. A wineglass full (2 oz.) should be added to each gallon of skim milk fed to the calves.

Water may be added to the stock supply of lime water as required and well stirred until all the soluble portions of the lime are dissolved, when a fresh supply of lime should be added to the barrel and well stirred.

When calves are put on to a skim milk diet a concentrate should be added to replace the butter fat. There are a number of suitable calf foods on the market.

A gruel can be made from 3 lb. crushed linseed and 2 lb. pollard added to 4 gallons of water and carefully mixed so as to avoid lumps forming. Boil slowly for thirty to forty minutes. One pint of the gruel should be added to each gallon of skim milk to be fed to the calves. A small quantity of the gruel or a calf food could be added when it is first fed to the calves, so that they may get accustomed gradually to the flavour, as the full allowance may cause the calves to refuse the food or may cause digestive disturbance.

CROWN LAND FOR GRAZING SELECTION.

APPROVAL has been given for the opening for prickly-pear development grazing homestead selection of land which was formerly heavily infested with prickly-pear in the Roma and Goondiwindi Land Agents' Districts.

One portion in the Roma Land Agent's District, comprising 10,352 acres, will be opened at the Land Office, Roma, on Tuesday, 6th February, 1934, for a term of lease of twenty-eight years, at an annual rental of ½d. per acre. This portion is situated 5 miles north of Yeulba, and is suitable for grazing cattle. The selection of this land will be subject to the ringbarking of 3,000 acres and the provision of one permanent water improvement during the first five years of the term.

Ten portions in the Goondiwindi Land Agent's District, situated from 16 miles to 60 miles north and north-west of Goondiwindi, will be opened at the Land Office, Goondiwindi, on Thursday, 8th February, 1934, for a term of lease of twenty-eight years, at annual rentals of ¼d. and ⅜d. per acre. The areas range from 8,800 acres to 30,000 acres, and one portion, which is suitable for sheep, is subject to a condition that it shall be enclosed with a fence which is both rabbit-proof and marsupial-proof, within three years from the date of the license to occupy. The remaining nine portions comprise cattle country.

Each portion is subject to special conditions requiring the ringbarking of areas ranging from 2,650 acres to 7,000 acres, and the provision of permanent water improvements within specified periods.

Free lithographs and full particulars of these lands may be obtained from the Land Agents, Roma, Dalby, and Goondiwindi, the Land Settlement Inquiry Office, Brisbane, and the Government Intelligence and Tourist Bureau, Sydney.

TO NEW SUBSCRIBERS.

New subscribers to the Journal are asked to write their names legibly on their order forms. The best way is to print your surname and full christian names in block letters, so that there shall be no possibility of mistake.

When names are not written plainly it involves much tedious labour and loss of valuable time in checking electoral rolls, directories, and other references. This should be quite unnecessary.

Some new subscribers write their surname only, and this lack of thought leads often to confusion, especially when there are other subscribers of the same surname in the same district.

Everything possible is done to ensure delivery of the Journal, and new subscribers would help us greatly by observing the simple rule suggested, and thus reduce the risk of error in names and postal addresses to a minimum.

General Notes.

Staff Changes and Appointments.

Mr. W. C. Jeffery, of Round Hill, Miriam Vale, has been appointed an Honorary Ranger under the Animals and Birds Acts in respect of the Captain Cook Memorial Reserve at Round Hill, which was recently declared a sanctuary under the Acts.

Mr. E. Jarvis, Entomologist, Meringa, will be transferred to Brisbane, and Mr. R. W. Mungomery, Assistant Entomologist, Bundaberg, will be attached to Meringa.

Messrs. J. Gunne (Helidon), J. J. Shelvey (Helidon), R. Pusey (Grantham), A. W. Noll (West Haldon), and J. Bishop (Kingaroy), Inspectors of Stock, Department of Agriculture and Stock, have been appointed also Inspectors under the Dairy Produce Acts.

Constable J. C. D. Doyle, Eulo, has been appointed also an Inspector under the Slaughtering Act.

Mr. F. J. Lentz, Numinbah, has been appointed an Honorary Inspector under the Diseases in Plants Acts.

Messrs. G. Bradbury and W. Harward, of Dunwich, have been appointed Honorary Rangers under the Native Plants Protection Act.

Messrs. F. R. Hugonin and A. Kehler, Magnetic Island, have been appointed Honorary Rangers under the Animals and Birds Acts.

Messrs. W. G. Hancock and K. King, agents under the Banana Industry Protection Act. have been transferred from Currumbin to Maryborough, and Maryborough to Currumbin, respectively.

Mr. J. W. Madill, of the Mirani Shire Council, has been appointed an Honorary Ranger under the Animals and Birds Acts.

Mr. S. A. Green, Inspector, Diseases in Plants Acts, Wallangarra, has been appointed also an Inspector under the Diseases in Stock Acts.

Banana Levy Regulation.

A regulation has been issued under the Fruit Marketing Organisation Acts, empowering the Committee of Direction of Fruit Marketing to make a levy on growers of bananas in Queensland, with the exception of those growers in the district from Nerang to the border, for whom a special levy regulation was issued in September last.

The levy is at the rate of one penny for every £2 or part thereof of the net proceeds from sales, and may be collected by agents, or persons holding to the credit of growers money on account of banana sales. The levy shall be collected by means of levy stamps obtainable from the C.O.D., which shall be affixed to account sales or credit notes.

In the case of bananas sold privately, the grower shall furnish a return of such sales to the C.O.D., and pay the levy due. Carriers of bananas shall furnish a monthly return to the C.O.D. of all fruit carried for market.

The sums raised by the levy shall be expended in the interests of the banana industry.

Levy on Stanthorpe Fruit and Vegetables.

A regulation issued under the Fruit Marketing Organisation Acts, empowers the Committee of Direction of Fruit Marketing to make a levy on growers of fruit and vegetables in the district being that portion of the State within a radius of 40 miles from Wallangarra, and in which area are situated the railway stations of Wallangarra to Dalveen, and Amiens to Fleurbaix. The levy will operate for a period of twelve months. The levy is at the rate of 1s. 6d. per ton of fruit and vegetables marketed, with a minimum of 1d. in respect of any one consignment by a grower who, in his own name or otherwise, contributes fruit or vegetables to any consignment. The levy this year replaces one of a lesser figure which has operated for about six years. The increase from 10d. to 1s. 6d. is made, firstly, for defraying the cost of the collection of the levy, and secondly, the balance shall form part of the Hail Relief Scheme Fund for the benefit of the growers in the district. The former levy of 10d. per ton was for the maintenance of the Deciduous Sectional Group Committee, although the bulk of the amount realised was actually used for hail insurance. This year, the whole of the proceeds, less cost of collection, will be devoted to hail relief.

Egg Board.

An Order in Council issued under the Primary Producers' Organisation and Marketing Acts, extends the operations of the Egg Board from 1st January, 1934, to the 31st December, 1938. An Order in Council was issued in October last, giving notice of intention to extend the Board, and inviting a petition from growers on the question of the continuance thereof. No petition was received, and the Order in Council formally extending the Board has accordingly now been issued.

Grade Standards for Plums.

A new regulation issued under the Fruit and Vegetables Act rescinds the existing grade standards for plums, and prescribes new standards. For the purposes of comparison, the following table sets out the grade standards approved in November, 1932, and those now approved:—

1932.—$1\frac{1}{8}$ inch—Little Gem, Evans Early, Blue Rock, Tibbits, Early Orleans. $1\frac{1}{4}$ inch—Doris, Duffy's, Wright's Early, Santa Rosa, Wilson, Angelina Burdett. $1\frac{1}{2}$ inch—Burbank, Giant Prune, Pond's, President, Grand Duke, Black Diamond, Magnum Bonum, Coe's Golden Drop, Kelsey, Wickson, Ballina, Shiro, Beauty, Formosa, Sultan, October Purple.

1933.—$1\frac{1}{8}$ inch—Early or Little Gem, Evans Early, Blue Rock, Tibbits, Early Orleans. $1\frac{1}{4}$ inch—Doris, Duffy's. $1\frac{3}{8}$ inch—Wilson, Angelina Burdett, Wright's Early, Santa Rosa, President, Grand Duke, Giant Prune. $1\frac{1}{2}$ inch—Burbank, Pond's, Black Diamond, Magnum Bonum, Coe's Golden Drop, Shipper, Kelsey, Wickson, Ballina, Shiro, Beauty, Formosa, Sultan, October Purple, Narrabeen.

Cotton Board Election.

The election of six members on the Cotton Board resulted as follows:—

District No. 1—

* John Beck (Stanwell) returned unopposed.

	Votes.
District No. 2—	
* Harry Reeves Brake (Wowan)	149
William Kendall McLeod (Buneru)	76
District No. 3—	
* James Patrick Fleming (Biloela)	267
Ernest Schuenemann (Goovigan)	219
George Herbert Bradley (Argoon)	96
District No. 4—	
Edward James Basson (Three Moon, Monto)	194
* James Bryant (Chowey)	177
Johann Theodor F. C. Benecke (Abercorn)	86
Samuel Harding (Philpott Creek)	66
Erich Max Schenider (Binjour Plateau)	66
District No. 5—	
* David Charles Pryce (Toogoolawah)	152
Charles Litzow (Vernor)	54

District No. 6—

* Ferdinand August Kajewski (Ma Ma Creek) returned unopposed.

* Present member.

All of the sitting members with the exception of Mr. James Bryant have been re-elected and they will be appointed together with Mr. Basson to hold office for a term of two years as from the 1st January, 1934.

Papaw Levy.

A Regulation has been issued under the Fruit Marketing Organisation Acts empowering the Committee of Direction of Fruit Marketing to make a levy at the rate of 1d. for every four cases of papaws marketed during the period from 1st January, 1934, to 31st December, 1934. The regulation prescribes the method of collection of the levy, and provides that all sums raised thereby shall be expended only upon advertising in the interests of papaw growers.

State Wheat Pool Extended.

A Proclamation has been issued under the Wheat Pool Acts, declaring that the provisions of these Acts shall apply to wheat harvested during the seasons 1933-34, 1934-35, 1935-36, 1936-37, and 1937-38. The present Pool automatically expires when the last of the wheat raised in the 1932-33 season is marketed.

A provision is included in the Proclamation that 500 growers of wheat—

(*a*) Who furnished to the State Wheat Board a return of wheat grown on land of which they are the owners or tenants for the 1932-33 season; or

(*b*) To whom seed wheat has been supplied by the Board for this year's planting for delivery of the resultant grain to the Board from not less than 10 acres of land of which they are the owners or tenants; or

(*c*) Who have grown wheat for delivery to the Board from an area of not less than 10 acres of land of which they are the owners or tenants,

on or before 8th January, 1934, may make a request for a poll on the question whether or not they desire the continuance of the Wheat Pool for a further period of five years.

Northern Pig Board.

Mr. D. Johnston, of "Hillcrest," Malanda, has been elected chairman of the Northern Pig Board in succession to the late Mr. H. T. Skennar. The other board members include Messrs. Robert Campbell (Peeramon), Mr. F. W. Collard (East Barron), J. E. Foxwell (Kureen), A. A. Knudson (Millaa Millaa), and E. Graham (Director of Marketing).

The Board has been appointed from the 1st January, 1934, until the 31st October, 1934, in continuation of the work carried out during the several years past. The Board elects its own secretary, Mr. C. Dunlop, manager of the North Queensland Co-operative Bacon Association, Limited, having occupied this position in the past as the Bacon Factory at Floreat Siding, Mareeba, functions under the general oversight of the Board. The latter takes the form of a commodity board functioning under the Council of Agriculture in Queensland, and in that capacity controls the marketing of pigs in the Atherton Tableland and Cairns Hinterland districts of North Queensland. The Board has performed a very useful and necessary service, and in co-operation with the bacon factory has resulted in the permanent establishment of the pig industry in that portion of the State.

Citrus Standards.

The Minister for Agriculture and Stock (Mr. Frank W. Bulcock) announced recently that Regulations had been issued under the Diseases in Plants Acts, which were designed to safeguard the interests of future planters of citrus orchards, and to raise the standard of production of this fruit in Queensland.

The new regulations are the outcome of a scheme formulated by the Acting Director of Fruit Culture (Mr. H. Barnes) for the use by nurserymen of selected seed for raising root stocks, and budwood which has been specially selected by, or under the supervision of, an officer of the Department of Agriculture and Stock, from trees of outstanding merit.

In effect, added Mr. Bulcock, the new regulations provide that all citrus trees sold or offered for sale in this State must be on stocks grown from specially selected seed. In addition two grades are provided. "A" grade consists of the following best varieties:—

Oranges—Washington Navel, Valencia Late, Joppa, Jaffa, and White Siletta,
Mandarins—Emperor, Beauty of Glen Retreat, and Scarlet,
Lemons—Lisbon and Villa Franca,
Grape Fruit—Marsh Seedless,

which have been worked with budwood specially selected by, or under the supervision of, an officer of the Department of Agriculture and Stock.

"B" grade consists of all other varieties of citrus, the budwood for working which must be specially selected by nurserymen from trees displaying desirable charactertistics.

It is further necessary for all nurserymen who raise citrus trees for sale to furnish a return to the Director of Fruit Culture by not later than the 31st October in each year, setting out the names and addresses of persons to whom "A" grade citrus trees were sold, and the number of trees of each variety sold to individual purchasers. By this means a careful check will be kept on the sale of citrus trees to ensure that growers will be supplied only with the very best.

Heavy Citrus Crop in Prospect.

The Minister for Agriculture and Stock (Hon. F. W. Bulcock, M.L.A.) announced recently that he had received a report from the Acting Director of Fruit Culture (Mr. H. Barnes) that excellent early spring rains have been experienced over practically the whole of the main citrus-growing areas of the State, and there are now prospects of a heavy crop of this fruit during the coming season. It is likely there will be at least a 50 per cent. increase over last season's yield. A factor which should react very much in favour of the Queensland growers is that the early rains caused the trees to blossom earlier than usual in many districts. The fruit as a result is well forward, and much of it should find a good sale in Sydney and Melbourne before the Southern fruit is matured enough to market.

Bird Sanctuary at El Arish.

Clump Mountain Farm, the property of Mr. R. C. Fenby, at Clump Point, El Arish, has been declared a sanctuary under the Animals and Birds Acts. It will accordingly be unlawful for any person to take or kill any animal or bird on this property.

Animals and Birds Sanctuaries.

Two more sanctuaries for the protection of animals and birds have been declared under the Animals and Birds Acts, and comprise the Toomba Stud Holding west of Charters Towers, and the property of Mr. St. J. Robinson, at Townsville. Part of the lastmentioned property was declared a sanctuary in June, 1930, but the Order in Council issued recently provides for the extension of the sanctuary to include adjacent breeding grounds for birds.

Mr. C. Fuller (Mapleton), C. M. R. Glover (Obi Obi), H. Bishop (Kidaman Creek), C. J. Mitchell (Kidaman Creek), H. N. Gannon, J. Cochrane, and K. Baedelt (Woodbury, via Yeppoon) have been appointed Honorary Inspectors under the Diseases in Plants Acts.

Mr. J. C. Cuthbert, Toll Gatekeeper of the Mount Nebo road, has been appointed an Honorary Ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Tung Oil Nuts.

As numerous inquiries have been received for seed of the Tung oil tree from persons desirous of experimenting in its growth, the Department of Agriculture and Stock has made arrangements whereby limited supplies of Tung oil nuts (*Aleurites fordii*) have been made available for distribution at the rate of 1s. 3d. per lb., including postage.

Applications, together with a remittance to cover the amount of the order should be forwarded to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Cane Assessment at the Kalamia, Pioneer, and Inkerman Mills.

An Order in Council issued under the Regulation of Sugar Cane Prices Acts fixes the assessment that may be levied on every ton of sugar-cane received at the Kalamia, Pioneer, and Inkerman sugar-mills at 2¼d. per ton. This Order in Council amends the Order in Council issued on the 5th May, 1933 (which fixed a general assessment of 1¼d. per ton on sugar-cane received at any mill in the State) in respect of the three mills abovementioned, the levy of 2¼d. to apply as from the 5th May last.

The proceeds of this assessment are to be utilised in paying for the checking by survey of the correct areas of the cane lands assigned to the mills mentioned. This checking is necessary to enable the Central Cane Prices Board to issue official certificates as to the assignment of particular areas of land.

Egg Board.

The time fixed for the lodging of a petition in connection with the continuance of the operations of the Egg Board for a further term of five years closed at the Department of Agriculture and Stock recently, and for the first time no petition for a poll was received.

With regard to the election of five growers' representatives for a term of one year, four of the present members—namely, Messrs. R. B. Corbett (Woombye), District No. 1, A. A. Cousner (The Gap), District No. 2, Tom Hallick (Mount Gravatt), District No. 3, and Walter Thos. Hughes (Middle Ridge, Toowoomba), District No. 5—have been returned unopposed.

In District No. 4 Mr. Alexander McLauchlan (Boonah), the present member, is being opposed by Mr. H. J. Jurgensen (Moogerah).

Voting papers for this election will be sent to growers early this month, and the date fixed for their return is on or before December 29th.

Rural Topics.

Milking Capacity of Dairy Cows.

After recording the milk yields and taking detailed measurements of 461 pedigree and grade Holstein Friesian cows in Minnesota (U.S.A.), Mr. F. H. Garner writes interestingly in the "Journal of Dairy Science" about the relationship that he found to exist between the measurements of different parts of the animals and their milk- producing ability.

With regard to measurements indicating mammary development, the writer points out that the blood leaves the udder by six different veins, and that only two of these, the so-called milk veins, are visible. Where the veins turn suddenly upwards, some 6 to 12 inches from the forelegs, the milk-wells are produced. The question arose as to whether the milk-wells were larger on bigger cows not because of higher milk yields but to be proportionate to the frames of the cows. It was found that the size of the cow did not materially influence the size of the milk-well. Measuring size by the height at the hocks, and holding this figure constant, a positive correlation was obtained between size of milk-wells and milk yield.

The writer concludes that the total area of the milk-well will take the tip of the middle finger of a normal man, and although one would never attempt to judge a cow by one point alone, the size of the milk-wells is probably the best single point indicating milk-producing ability. It is further stated thot there may be a close relationship between the size of milk-wells in parents and the milking capacity of their daughters.

The writer also found that it was important that a cow should have a long body; the relationship here was not much but nevertheless significant. He found that the height of the hindquarters of the cow was more highly correlated with milk yield than the height of the forequarters. The co-efficient of correlation between yield and width at the hocks was also significant, and bears out the opinion of judges who prefer a cow with a large pelvis girdle.

With regard to constitution, a significant correlation was obtained between the circumference of chest and milk yield, but not between depth and width of chest, though the writer concludes that these last two measurements could not be so accurately made as the first. "Capacity" was measured by the width of barrel at the thirteenth rib, and by the circumference of barrel, and again a significant correlation was obtained.

The Milker's Hands and Bacterial Infection.

Dairymen who milk with dirty hands should consider the effects their slovenliness might have, not only on dairy products, but on their fellow-beings. Often this carelessness is due, not to lack of personal cleanliness, but to want of knowledge of bacterial life. Let every dairyman have a look at his hands when dirty, and ask himself if he would like to see the baker from whom he buys his bread kneading his dough with hands in a similar condition. He would say that such a baker was a dirty person, perhaps even use stronger language. Yet bread is subjected to a temperature in the oven high enough to kill the organisms, whilst milk is generally consumed in the raw state.

After the milking of each cow the milker should wash his hands in clean water and dry them; if this is not done bacteria that may be in the liquid on the hands may gain access to the milk in the bucket. It is unnecessary to defend washing on the score that any time expended on it is subsequently made up, for even if the time were actually time lost, its expenditure would still be well worth while. It is contended, however, that any time occupied in washing the hands is made up eventually by reason of the stimulating effect of the water on the hands of the milker. As a shower invigorates a tired body, so does a wash invigorate the milker's tired hands and wrists.

Supposing that fifteen seconds is taken up in washing the milker's hands and the udder in the case of each cow, and that one milker milks sixteen cows at a sitting, this would mean a total loss of about four minutes, but the increased speed of milking would easily make up this time. Moreover, as every dairyman knows, the more actively the milking is done the more the activity of the milk-secreting cells is stimulated, hence more milk of better quality.—A. and P. Notes, N.S.W. Department of Agriculture.

The Milk Yield.

Analysis of statistical data from milk recording societies has disclosed that the milk yield is considerably affected by the length of time that elapses after the cow calves and before she is served, and by the length of the dry period.

Studies of the growth of the udder have shown that it commences at the twentieth week of pregnancy, at which time, if the cow is already in milk, the yield begins to decrease rapidly. Since the udder cannot both produce milk and develop its maximum growth, one or both functions must suffer. Cows which are milked up to the time of calving, accordingly yield much less milk during the next lactation period, a dry interval of forty to sixty days being required in order to produce full growth of udder tissue for the next lactation. The feeding of cows on a milk-producing ration during this period considerably increases the udder growth and consequently the milk yield during the following season.

Variety in the Cow's Ration.

In making up combinations of concentrates and roughages it is as well to remember that there are, unfortunately, very few foods that alone are able to supply a full range of all the essentials, and therefore the most satisfactory rations must, of necessity, include in their make-up a fair variety of foods from different plants. Care should be taken to avoid choosing roughages and concentrates that are derived from "the one stalk," as, for instance, wheaten chaff and bran, corn silage and ground maize meal, green oats and ground oatmeal, &c. The same idea can be extended to cover the undesirability of combining two substances that are deficient in the same essential, such as, for instance, maize meal and bran, both of which are lacking in lime.

The same principles apply in the growing of crops, and explain the remarkably superior results obtained from feeding a crop of oats that has been mixed with a certain percentage of legumes, such as peas, vetches, tares, &c., in order to make up for the deficiencies in the composition of the oats, or, say, a crop of green maize that has been mixed with either soy beans or lucerne to correct the same defect.

The Flax Industry—Little Prospect of Success in Australia.

Because of the large importations of linseed for the production of oil as well as the possibilities of an export trade in fibre, the Department of Agriculture in New South Wales has for many years been conducting experiments in an attempt to establish as an industry the growing of the linseed. Seed of a large number of varieties from all parts of the world where linseed is produced have been imported and tested, experiments being conducted at various experiment farms and in co-operation with many farmers under various conditions of soil and climate, but the results generally have been disappointing.

The probable reasons for the failure of linseed to thrive in this State are the irregularity of the rainfall and the short duration of the spring. The cereals, wheats and oats, are able to withstand dry spells which occur during their period of growth, but linseed appears to be checked by periods of scanty rainfall and by the high temperatures which are frequently experienced during the spring months.

Though the Department is continuing its experiments in an effort to discover means by which the crop can be produced profitably in this State, it does not at present encourage farmers to undertake the commercial cultivation of linseed.

That the experience in New South Wales has been similar to that in the other States of Australia is now evident from a report on the flax industry made available by the Development Branch of the Prime Minister's Department.

In this report it is pointed out that the world's price for flax, expressed in gold currency, is at present close to pre-war level and little improvement can be expected. Linen goods are not manufactured in Australia, and the only local market is the limited soft fibre requirements of rope and cordage manufacturers at present met by the importation of Italian hemp.

Experience has shown that climatic conditions render the greater part of Australia's farming territory unsuitable for the production of the crop and that the general quality of Australian fibre can only be ranked as medium to poor.

Unsatisfactory results have attended efforts to grow linseed, and until it can be demonstrated that the crop is profitable, farmers will not be interested in its cultivation.

Estimates of the cost of production of linseed indicate that a yield of 12 bushels per acre, at a price of £14 to £15 per ton would, at the present time, just about provide wages and pay expenses.—A. and P. Notes, N.S.W. Department of Agriculture.

Worms in Horses—Influence of Feed.

There is a totally inaccurate belief in the minds of many farmers that the common worms which infest horses are to be found readily in the mud of dams and creeks, pointed out the District Veterinary Officer to a recent New South Wales Bureau Conference, and the speaker went on to explain that such a belief renders the intelligent control of these parasites quite impossible.

There are many different types of worms which infest the stomach, small and large intestines of the horse, but the methods of propagation of all these worms is very similar. Tens of thousands of the smaller and most harmful species may be present in one animal, and each female of this huge collection lays thousands of eggs. The eggs pass out with the droppings and develop into larvae which are scattered all over the paddock, and it is the swallowing of these microscopical larval forms while grazing which causes the animal to become infested with worms, for the larvae develop to adults in the bowels; and so the process continues to the detriment of the horse population.

Horses do not often contract worms when they are in work, for the reason that they are being well fed and maintain their strength and resistance, and do not have the same opportunity of picking up the worm elements in the paddock. After harvest the horses are turned out for a so-called spell, often on feed which lacks nourishment; they lose their real strength and resistance and being always in the paddocks they pick up quantities of worm larvae and before long they are too weak and wormy to work.

It was suggested by the lecturer that all of this trouble could be avoided by looking after horses well at a lean time of the year when they are not in work. If good feed was not available and it was not possible to change the horses fairly frequently to a fresh paddock (and this was important), then good care should be taken that they receive some hand-feeding. In addition, it was well to learn to recognise when horses were getting "wormy" and see that they were drenched before it was too late.

Spread Manure—A Profitable Practice.

If the cow dung is not harrowed regularly after each grazing, they produce patches of rank growth which are left by stock throughout the entire season, said a lecturer at the recent Illawarra District Agricultural Bureau Conference at Camden (N.S.W.). This condition increases with each successive grazing and results in the loss of a large proportion of valuable grazing area; it may even happen that much of this manure-covered land, if not harrowed, will not be available for years unless ploughed in or removed in some way.

After careful observation it has been calculated that the year's manure from thirty cows contains fertility equal to that found in the following commercial fertilisers:—9 tons sulphate of ammonia, 2½ tons superphosphate, and 4½ tons sulphate of potash. At present prices these would be worth about £200 per year to the farmer, and would represent a very real contribution towards his farm's upkeep.

On the other hand, if the droppings are left unspread, the capacity of the pasture is limited in many respects. The wisdom of using the grass harrow to spread the droppings is therefore very apparent.

An Easily-made Tank Stand.

A suitable stand for a tank can be made by filling a ring of corrugated iron with sand. The ring should, of course, be well riveted, and it is also advisable to further strengthen it by means of hoops of fencing wire twitched up hard against the iron.

The greatest pressure on the floor of the tank will be about its centre, and it is advisable, therefore, to give the sand filling a slight crown at the centre so that the tank, when full, will settle with a level floor. The life of the floor of the tank, and also of the ring of galvanised iron, will be greatly extended if the surfaces coming in contact with the sand are given a wash of cement.

Prosperity and the Hen.

The business people in some of our poultry-farming centres do not always realise what a factor the poultry-farming industry is in the prosperity of their town. Take Parramatta, for instance. Approximately £300,000 worth of eggs and poultry are produced annually within a radius of 10 miles of this town, in addition to which probably £30,000 worth of day-old chicks are sold, and £200,000 is expended on supplies to produce this income. Probably if the townspeople of Parramatta and other business centres in the poultry-farming districts visualised what they owe to the humble hen they would, like the people of Petaluma, California, erect a statute of a hen in the main street.—A. and P. Notes, N.S.W. Dept. Agric.

Lucerne as a Pasture—Why Continuous Grazing is Detrimental.

For normal development a plant must have a certain amount of leaf surface for the conversion into available plant food of the mineral solutions absorbed from the soil by the roots, and because it interferes with this process, heavy continuous grazing is seriously harmful to lucerne. The correct method of handling the paddocks is to wait until the growth is approaching the bud or early flowering stage, and then feed it off rapidly by stocking the area heavily. It is advisable to have reasonably small paddocks, and to put large numbers of sheep on at a time to eat the area off in at least ten or twelve days. If the paddocks are large, temporary fences that can be erected rapidly and moved easily should be utilised for the purpose of subdivision.

In paddocks that are grazed the surface soil sets hard with tramping, and cultivation should be carried out at least twice a year, using springtooth or rigid fine cultivators fitted with special lucerne points. Top-dressings at 1 to 1½ cwt. superphosphate per acre should be made at least every second year. The fertiliser should be applied in July or August, working it in with a cultivator or heavy tripod grass harrow.

Hoven or bloat is likely to occur in sheep and cattle at any time if the animals are hungry when first turned on to the paddock, and the trouble is accentuated if the lucerne is wet with rain or dew. Once sheep become accustomed to feeding regularly on lucerne, however, very few deaths occur. A mixed pasture of grasses and lucerne minimises the danger to a considerable extent, as a variety of feed is available.

Having grass paddocks to which the sheep have access, adjacent to the lucerne areas will result in a better balance of feed than where only lucerne is available. This practice considerably reduces the danger of hoven, and also results in the life of the lucerne plants being extended, as the stock are not feeding on them continuously. It is the young, succulent growths of lucerne which cause most losses from hoven, and whenever possible the feed should be allowed to become more mature and reach the bud or early flowering stage before it is grazed off.—A. and P. Notes, N.S.W. Department of Agriculture.

A Call for Courage—A Message to Modern Youth.

Arthur Mee, whose books and papers have been read by millions while this generation has been growing up, has been looking around the world, seeing Youth everywhere waiting for its opportunity, listening impatiently to its suggestion that it has no chance in these days. This is the message contained in the preface of a new book he has made:

"It is not true that there is no chance for Youth in this twentieth century. There have been dark days before and men have faced them. What Youth needs is not Opportunity but Courage.

This generation has seen millions pass through the fire; it has seen an outburst of heroism unparalleled since Time began. The end of that vast stricken field is the ruin of the world, and everywhere the call is for heroes who will build it up again. The cry is for the courage that will not fail, the spirit that will not quail, the eager brain that sees the boundless chances of this brave new world.

All through the ages there have been such men, such women. If life is hard to-day it was harder a thousand times for them, but they went on. They did incredible things. They made the world we live in."

In his new book Arthur Mee tells us their stories. There is the slave writing the fables every child loves. There is Captain Cook making the British Empire possible, Faraday peeping into electric mysteries, Clerk-Maxwell founding the Wireless Age with nobody believing him, Gurney dreaming of motor cars with everybody mocking him, Hargreaves the Australian making his aeroplane models and scoffed at as a crank. (Because there was no room for Hargreaves's models at Canberra they eventually found a home in a German museum and were regarded as of priceless value to German aeroplane designers before and during the war.) There is Cervantes pulling at a galley oar with Don Quixote rippling in his brain, Grotius locked in his box with the League of Nations in his mind, and many more tales of human achievement against the greatest possible odds in every age, and of men who made our race immortal. "Time is calling again for those who will build a world," and in the great records of our own land, and especially in the lives of Australian pioneers, our youth will find its inspiration. "What Youth needs is not Opportunity but Courage—the courage that will not fail, the spirit that will not quail, the eager brain that sees the boundless chances of this brave new world."

Care of Eggs on the Farm.—Important Points.

Much can be done by the poultry farmer to preserve the quality of eggs going to the market, yet in some instances there is an astonishing carelessness in handling this perishable commodity. One of the first considerations is the nesting arrangements—it is essential that sufficient nests be provided to prevent crowding, which causes breakages and dirty eggs. The nests should be kept clean, as should the houses, so that the number of soiled eggs is reduced to a minimum, because any dirt on the shells, particularly those which are porous, may lead to infection by harmful bacteria, thus causing the eggs to go bad quicker than if they were clean. The trouble would be accentuated if such eggs, while being washed, were allowed to stand soaking for any length of time in dirty water. This should be avoided by placing the eggs in a receptacle with a perforated bottom and immersing them in water for a few seconds, afterwards washing them in clean water.

Where heavy breeds are kept it is essential that broody hens be handled systematically, so that they do not sit on the eggs and thus cause deterioration, particularly if the eggs are fertile—if they were sat on for twelve hours incubation would commence, and, of course, the eggs would quickly go bad. To avoid this risk the best method to adopt is to have portable crates, with slatted bottoms and divided into two or three compartments so that each day's "broodies" can be placed in a separate compartment. It is important that all broody hens be caught each day. This not only helps in keeping up the quality of eggs, but saves loss of production, because by catching the hens as soon as they go broody they will be off the brood again in a few days, whereas if they are allowed to sit for two or three days they will be off laying longer.

Another matter bearing upon the quality of eggs is that of correct feeding. For instance, if green feed is fed to excess in place of more nutritious food, this will lead to watery albumen in the eggs. On the other hand, a too highly concentrated ration will cause a greater percentage of blood spots, which are objectionable in a fresh egg and affect the keeping qualities. Again, a regular supply of suitable shell grit is an essential in ensuring sound shells.

Finally, the method of storing eggs on the farm awaiting despatch to market often leaves much to be desired. The room in which the eggs are kept should be free from mouldy or musty odours, and, while allowing sufficient ventilation, must not be too draughty. The temperature of the room is another important matter, especially in the hot weather, when the eggs should be kept as cool as possible. Where a cool room is not available the best course to take is to pack the previous day's eggs early the next morning, and, after packing, cover the cases over until they are sent to market.

On no account should eggs be allowed to stand exposed to the air during the warm weather, as this leads to rapid evaporation, and results in eggs being rejected as stale.—A. and P. Notes, N.S.W. Department of Agriculture.

Correspondence Course of Instruction in Pig Raising.

This course which has been in operation since the 1st March, 1932, has proved to be one of our most effective means of instructing farmers in the subject of pig raising, and has been the means of interesting many farmers in the improvement of their pig breeding and housing methods. The letters of appreciation frequently received from those receiving the course are very encouraging and indicate that the instruction given appeals to the interested farmer.

Up to the present, 206 students, aged from 14 to 40 years, have commenced the course; 17 of these have completed and 80 are still enrolled; 109 commenced but discontinued the study at various stages of the course. Some of those who have dropped the study have explained that circumstances, such as change of employment and seasonal work, have made it impossible for them to continue. Others give no reason for their discontinuance, and in many cases it is probably due to negligence.

If a student gets a month behind in his work he is sent a circular letter reminding him that he is expected to complete the course; this sometimes has the effect of bring him back to his study.

Although a student receives benefit even if he only pursues a small portion of the course and the time spent on him is not wasted, it is most desirable that when a student enrolls for the course he should complete it within the specified time of one year.

The Hydraulic Ram.

An ample supply of fresh water is often a problem on many dairy farms and, paradoxical though it may seem, this problem is often most acute in districts where the yearly rainfall is heaviest—the rainfall is seasonal and there is rarely any means of conserving supplies for the drier months. It is seldom, however, that running water cannot be found on a dairy farm in the coastal belt, although, admittedly, it is sometimes difficult of access. Furthermore, on the hilly dairying lands much energy is expended by cattle in travelling to and from the water supply. This results in lessened production. How much better to have drinking troughs quite handy and fed regularly with fresh water from these otherwise inaccessible sources by means of a hydraulic ram! The supply thus made available can also be made to supply water for the household and dairy.

When properly installed and adjusted the hydraulic ram will work day and night if necessary without attention; in other words, it is a close approach to perpetual motion. The only essential is a fall or "head" of water. The quantity of water a ram will deliver varies under different conditions, but it may be taken as a general rule that one-seventh part of the water which enters the ram can be raised and discharged four times as high as the "fall" applied. Thus a fall of 10 feet would raise 1 gallon out of every 7 entering the ram 40 feet high, or half a gallon 80 feet high.

Considering the comparative cheapness of a ram and that the cost of operating and upkeep is nil, it is difficult to understand why it is not more generally utilised on farms. The only conclusion that can be come to is that it is not appreciated because it is not understood. Its construction and working are so simple that farmers could not be blamed for regarding with scepticism many of the claims made for this machine. What it will do and the principles on which it works, however, are set out very clearly and briefly in the current issue of the "Agricultural Gazette" of New South Wales.

Cheese a Valuable Food.

It has often been said—indeed, it has become quite a common saying—that cheese is indigestible, and should, therefore, be avoided by anyone subject to digestive troubles. On the contrary, points out a departmental dairy instructor in the N.S.W. "Agricultural Gazette," when cheese of choicest quality is matured, it is in actual fact more digestible than many other foods we eat, and is often specifically recommended by medical authorities, not only for people in normal health, but for those suffering from dietetic troubles. Food analysts tell us that 1 lb. of cheddar cheese contains as much protein as 1½ lb. of sirloin beef and 1¾ lb. of white poultry flesh, and, on the basis of the energy it supplies to the human system, that 1 lb. of cheddar cheese is equal to 2 lb. of sirloin beef or 2½ lb. of white flesh from the breast of a fowl.

What a difference in energy value there must be then between a meat sandwich and the tasty cheese sandwich, and what an astounding difference it would make in the quantity of cheese consumed every year if only half of the people in this State ate daily the quantity of cheese it takes to make a full sandwich, say, half an oz.

Green Peas—Cultivation on Trellises.

On the New South Wales coast, particularly in the Gosford and Dora Creek districts, the growing of green peas on trellises is a common practice, and is particularly suitable for small growers in these and similar districts. The advantages claimed for this system are many. The yields are increased, picking is rendered easier, less disease is present on the haulms, the rows are more easily cultivated and kept free of weeds, and the plants are not affected so much by continued wet weather.

The method of constructing the trellis is as follows:—Stout stakes 5 feet long are driven 6 inches into the ground at intervals of about 20 feet along the rows. As the peas grow, horizontal wires a little thicker than tie wire are alternately spaced on both sides of the stakes every 6 or 8 inches, or in pairs at the same distance, up to a height of 4 feet 6 inches, according to the growth of the vines. The wires are strained to stout short pegs at each end of the rows. The rows are usually spaced about 4 feet apart. Yields of up to 400 bushels per acre have been obtained by this method, according to reports.

A modification of the method, and one often employed by backyard vegetable growers, is to use sticks and bushes to support the plants.

Fodder a Form of Stock Insurance.

Adequate fodder conservation is merely another term for insurance. Secondary industries have long since recognised the necessity of covering their operations with adequate insurance, and the need of primary industries in this respect is considerably greater.

As to the benefits to be derived from advanced business methods as expressed in the storage of fodder, one has not to go far for examples. In practically every district are to be found producers whose initial step on the ladder of prosperity has been made possible through foresight and good management in having available reserves not only to enable them to obviate losses in their stock but to swell their revenue by availing themselves of the drought fodder prices. Progressive methods, following the lines of crop rotation, lucerne culture, and pasture improvement have materially increased the carrying capacity of the holding. Full use is invariably made of this increased capacity by additions to the farm flock, which in turn involves fodder conservation.

Ample reserves of fodder permit of stocking to the full capacity year in and year out without undue anxiety and risk, and at the same time permit of securing the maximum monetary return. One has not to await recognised droughts to obtain the benefits of fodder reserves. The judicious feeding of sheep during the unfavourable periods which occur every year or two will be amply repaid in the increased return from the wool clip. Droughty stretches of even minor severity invariably leave their mark in the growth of wool, and the assurance of a free, sound, healthy-growing staple yearly will do much towards establishing a reputable and sought-after clip. Further, in the production of fat lambs it is essential that they receive no check whatever if a product of high quality is to be obtained. A ration of crushed oats at a vital time may mean the turning point in favour of a first-class product.

It is merely a recognised business practice to share one's risk per medium of insurance, and for the farmer the most effective means of accomplishing this is to provide adequate forage supplies. By this means he guards against the undue depreciation of his assets, at the same time guaranteeing continuity of production and revenue.—A. and P. Notes, N.S.W. Dept. Agric.

Bush Fire Control.

The strong growth of grass that has followed spring rains in many parts of the State will dry out with the advance of hot summer weather, and unless adequate steps are taken to control outbreaks of bush fires, serious damage to property and losses of stock are likely to be the result. In these difficult times, especially, primary producers should take every possible precaution to ensure that avoidable losses do not occur, and one of the means by which this may be achieved is the immediate formation of efficient fire-fighting units, by means of which it is comparatively easy in many districts (especially open country) to control bush fires.

The value of bush fire brigades has been well proved in many Western localities of New South Wales—for example, the Griffith-Hillston and Parkes districts, where within the past few years several serious fires have been quickly brought under control by fire-fighting units before any great damage was done.

Already this season a number of fires have occurred in the Southern States, thousands of acres of grass having been destroyed in the Jerilderie district and haystacks and even farm buildings in other localities.

Primary producers generally should profit by these experiences and give timely consideration to the formation of efficient fire-fighting units in their districts, and so provide for minimising the damage from bush fires. This is a movement that could well be taken up by branches of the Queensland Producers' Association, which should experience no difficulty in securing both the executive and the personnel.

When fighting bush fires, systematic and capable organisation may be said to be the essentials to success, and for a brigade to attain the peak of efficiency and usefulness it must have, not only the loyalty of every member of the unit, but also the wholehearted support of every section of the local community. Commercial and other interests in rural districts should realise that loss is never individual—it is always felt throughout a community—and that they can effectively assist in the provision of adequate protection from fire losses, not only by direct subscription, but also by the supply of equipment at landed cost.

Scours in Calves.—Various Causes.

Any irritant material eaten by calves is likely to set up inflammatory changes in the stomach and bowels, and thus, where the animals have had access to poisonous substances, or poisonous plants are growing in the paddocks, consideration should be given to these conditions when endeavouring to ascertain the cause of the occurrence of "scours."

Poisons containing arsenic are employed for so many purposes, such as sheep and cattle dipping, weed destruction, &c., that there is a tendency to overlook the poisonous and dangerous nature of the material used, and there is frequently a lack of care in its handling. Arsenical preparations often have a salty flavour and are readily licked by stock.

Certain plants, too, are capable of causing gastritis and enteritis, and when seasons are dry cattle will often eat herbage and shrubs which they would leave untouched at normal times. For instance, bracken fern is commonly eaten in such circumstances and may be responsible for considerable loss. There is therefore necessity for a careful survey of the paddocks where the sickness and mortality are occurring, so that any evidence that plants, usually not eaten, have been taken by cattle, can be observed.

More common and significant types of scours, however, are those due to microbes in the bowel, and to parasites in the bowel.

Zebu Cattle.

The proceedings for 1933 of the American Society of Animal Production contains a paper dealing with the growth of different types of cattle in Louisiana, including crosses with the Brahman (Zebu). The writers state that the Brahman is pre-eminently a grazing animal and makes good gains on coarse grasses. The Brahmans do not appear to suffer to the same extent from flies, mosquitoes, and external and internal parasites. They also stand the heat better. Further, at the Louisiana Station no Brahman grades have died from bloating on clover, while losses among the breeds of British origin are sometimes severe. The authors state that the principal advantage of the Brahman lies in its capacity for making gains on grass alone, a quality that is of great importance on the coastal plains.

Importation of Stud Pigs.

In recent months several valuable stud pigs have been introduced into Queensland from overseas and other States, all with a view to strengthening existing studs and building up foundation stock in the pig industry.

Notable among the importations are the two Berkshire sows recently released from quarantine and now on the property of the owner, Mr. F. Bach, of Oakey. These sows represent the very best it is possible to obtain in the United Kingdom, and, in fact, one sow, Lenton Patience, was a first prize winner at the Royal Agricultural Society Show, Yorkshire, England. She has farrowed her first litter since arrival and is doing well. The younger sow, a full sister to another very prominent prize winner, has been mated to the champion boar at the Farm Home for Boys, Westbrook.

The Queensland Agricultural High School and College secured one of the most attractive Berkshire boars offered at the Melbourne Show sales. This boar, himself a first prize winner, was much sought after and at auction would probably have realised considerably more than the price at which he was obtained.

The College also secured a very fine Berkshire sow and a Large White boar and a pair of specially selected Large White sows.

The most recent introduction is a prize-winning Tamworth sow purchased at the Melbourne Show for the Ascot Vale Stud Piggery, owned by the veteran breeder, Mr. W. S. Hendry, of Clifton. This sow, which had been on loan to the Victorian Department of Agriculture, toured the State on the Better Farming Train, prior to winning first prize at the Melbourne Show. A four months' old boar of her first litter also won first prize in a strong class at the same show. Mr. Hendry intends later on to mate this latest importation with his champion boar, Byron Challenger, the sire of which was champion at the Brisbane Royal National in 1932 and 1933. Although only a little over three years old he has a record of over forty first prizes and championships.

These importations, together with a distribution of stud pigs in the most popular breeds, and the large number that have been distributed through the Better Boar Scheme of the Department of Agriculture and Stock emphasises the importance of the industry and indicates a desire on the part of farmers to improve their breeding stock with a view to providing more intensively for local, interstate, and overseas markets.

Why Pigs Eat Charcoal.

Why do pigs eat cinders, charcoal, burnt corn cobs, and why do they persist in chewing bones? This is because their bodies demand a certain amount of mineral matter and such substances as charcool, burnt corn cores, burnt or charred bones, lime, ashes, all contain necessary mineral nutrients and in order to obtain these the pig satisfies the craving by indulging in the habits referred to. Give the pigs liberal supplies of mineral matters, sterilised bone-meal, and keep them growing and developing to advantage.

Gruel for Calves.

When the young calf is changed over from a diet of whole milk to one of skim milk, some form of concentrate should be added to replace the butter-fat that has been removed in separating. Experience has shown that an excellent addition is a thick gruel made from 3 lb. of crushed linseed and 2 lb. pollard, carefully stirred into $3\frac{1}{2}$ or 4 gallons of water, and slowly boiled for at least half an hour. One pint of this should be added to each gallon of pasteurised skim milk, also one wineglass (2 oz.) of lime-water.

This gruel should be added in small quantities at first, so that the calf may become acquainted with the flavour, also so that its digestive system may adapt itself to a new class of food. If fed in full quantity at first the animal may either refuse the food or will be rather severely scoured by it.

How to Transfer Bees.

The objects of the compulsory use of frame hives are to facilitate the work of apiary inspection and the control and eradication of diseases found in bees. The best time to carry out the process of transferring bees from a box or other imperfect hive to a regulation hive with frames is in the spring during the first honey flow. Brood-rearing is not then in full swing, and combs are not overladen with honey. The danger of robbing is also minimised by the presence of nectar in the fields. The work should be carried out on a sunny day when most of the field bees are out.

First, prepare a standard-sized hive body complete with frames, and standard-size bottom board and cover. All the frames with the exception of one should be wired, and contain sheets (preferably full ones) of comb foundation. Give the bees in the box hive some smoke, and remove the hive from its stand, and substitute for the time being the frame hive minus the one empty frame; this new hive on the old stand will keep the field bees occupied for a while. Next turn the box hive upside down, remove its bottom board, and place an empty box, open side down, over the combs; have a neat fit if possible. Drum the bees up into the empty box by beating on the sides of the box hive with two stout pieces of wood. When completed remove the box now containing the bees and place it temporarily over the frames of the new hive on the old stand.

The combs may now be removed from the box hive. The best pieces of worker brood combs should be cut to fit neatly in the empty frame, and made secure with string fastened right around the top and bottom bars.

Next lift the box of bees from above the frame hive, and place the frame of brood about the centre of the frame hive; replace the cover on the frame hive, and then dump the bees from the box at the entrance of the new hive, and allow them to enter. It is usually best to dump a few first and see that eager entry is sought, and then bump the remainder out. The bees should make a contented start in their new home, having brood for inducement.

An Alternative Method.—After the first box hive has been successfully transferred as described and good headway made in brood rearing, other box hives may be transferred by what is known as the second method of transferring.

Secure a frame of brood (preferably with some larvae), and place it in a new prepared hive fitted with comb foundation. Invert the box hive, place the frame hive minus its bottom board over the combs, and then drum the bees up into the frame hive. When the drumming is completed, the new hive, now containing the bees, is placed on its bottom board on the old stand.

Remove the cover of this new hive and place a queen excluder over the frames; then on top of the excluder fit the old hive to act as a super for the time being. In three weeks a good brood nest should be established in the frames, and all of the brood in the old box above will have emerged, the queen being unable to return to it.

The box may now be removed and the bees drummed out of it into an empty box and then dumped in front of the new hive. The combs can be removed from the box hive and the honey and beeswax made use of. There is no loss practically with this method of transferring.—A. and P. Notes, N.S.W. Dept. Agric.

Is This a Farrowing Record?

Mr. Harry S. Pedlingham, a small farmer residing at Hardwick Farm, Colwall, near Malvern, Worcestershire, England, is the owner of a Large White sow that appears to be the world's most prolific and profitable pig.

On 8th January of this year this remarkable sow produced her nineteenth litter, bringing the total number of pigs that she has farrowed throughout her career to 353. The sow, despite the fact that she is now well over ten years of age is still in healthy breeding condition, and Mr. Pedlingham's ambition is to achieve a figure that will irrevocably establish the record for prolificacy for Great Britain for all time. Her owner expresses the conviction that 400 pigs would be quite a moderate estimate of the sow's breeding possibilities.

An outstanding feature of her breeding career is the fact that a litter well above the average number has been farrowed with the regularity of clockwork each and every six months since 12th December, 1923, when the sow commenced its record-breaking career at just under twelve months of age.

A further remarkable feature was the farrowing of three litters with a total of sixty-five pigs in the year 1930, and it is worthy of note that seven litters of twenty and over have been produced. Mr. Pedlingham attributes the large and consistent farrowings chiefly to contentment engendered by regularity of habits and feeding. The importance of weaning such large numbers and minimum of time to permit of a further farrowing in as short a period as possible was not overlooked. To achieve this later object correct and regular feeding was essential. Only first-class boars have been used. That the pigs were of good quality is substantiated by weight of age records. At nine weeks of age eight pigs from one litter were weighed and tallied as follows:—

Eight pigs weighing 50, 48½, 49, 49½, 48, 50½, 47, and 42. These pigs averaged 34 lb. at seven weeks of age—a good average indeed. To illustrate that the prolific characteristics of this sow have been passed on to the offspring, it is worthy of note that a sow farrowed in one of the litters of twenty-one born on 19th July, 1929, has already broken its dam's record over a given period. Another has so far made an average of sixteen to a litter and a boar that is now just over twelve months of age has achieved sixteen pigs in his first litter. The majority of the sow's offspring which have been disposed of for breeding purposes show the same gratifying results. The full details of the sow's farrowings up to 9th January, 1933, are shown below:—

Date.	Year.	No.	Date.	Year.	No.
2 December	1923	12	19 July	1929	21
15 June	1924	24	1 January	1930	24
28 December	1924	18	13 July	1930	21
11 June	1925	15	29 December	1930	20
25 December	1925	19	30 June	1931	16
24 June	1926	18	4 January	1932	14
2 January	1927	16	2 July	1932	18
3 July	1927	19	3 January	1933	16
5 January	1928	19			
29 June	1928	22	Total, 19 Litters		353
4 January	1929	21			

The Late Dr. Bancroft.

Dr. Thomas Lane Bancroft, who died recently at Wallaville, near Bundaberg, was the famous son of a famous father, whose memory is commemorated in scientific circles in Brisbane by the annual Bancroft lecture. Dr. Bancroft, the senior, may be regarded as the pioneer in Australia of medical research directed towards advancing the white settlement of our tropics. He came to Brisbane as a young English doctor, settled here, and gained an international reputation for his scientific work, particularly for his investigations into the cause of filariasis. Sir Ronald Ross, the later discoverer of the way in which malaria is spread by mosquitoes, acknowledged a heavy debt to the elder Bancroft. Dr. T. L. Bancroft carried on the work of his father after the latter's death in 1894, and his subsequent intensive study of the ceratodus furnished contributions to knowledge that were highly valued in the international world of science. Men such as he receive much less honour from their fellow citizens than a popular cricketer or footballer, but the honour they confer on the State will outlast most sporting laurels.—"The Queenslander."

Thought, Its Power, and how we fall down on the Job.

Following is an excerpt from a striking editorial in a recent issue of "The Producers' Review" (Toowoomba, Q.):—

With reluctance we have been forced to the conclusion that human nature readily finds a groove which shackles it to the ordinary every-day task of earning a living. The tragedy of many potentially able minds is that routine work and routine thinking become almost automatic, until the ability to think along original lines is destroyed, in the same way as a limb becomes atrophied if it is not in use. To-morrow will not bring anyone greater power and authority unless these are being stored to-day.

How can men acquire the ability and the habit to think freshly, critically, and dispassionately on problems which confront humanity? Perhaps the starting point is in a recognition that the ordinary daily task is but a repetition of habits and thought applied until it can be performed as easily as rolling off a log, and a realisation of that fact will show that in its doing there is no real advancement or development of faculties.

The next stage of effort is in the determination to do some concentrated thinking on problems other than the day's work. This can be done by applying the advice of a great thinker, who once said:—

"I believe in working on second wind. If a man is satisfied with just three meals a day and a roof over his head, perhaps he can manage to satisfy his wants by an ordinary day's work. But if he wants to store up reserve meals and shelter against the coming years, or build something worth while, he will have to learn to use his second wind. At the end of an ordinary day's work you feel fatigued. Pressing on further may seem difficult, even impossible. But if you will make this second start—draw on your second wind—you will soon uncover new layers of energy. Fresh supplies of working force come to your aid. Moreover, after a time, you can accommodate yourself to that additional effort, and not mind it. When this second supply is exhausted, you can uncover still another layer of energy."

All of us are potentially amenable to development. The men who achieve important positions in life depend less on their natural aptitudes or inherited gifts than on the acquired ability to fix attention upon a specific problem and to hold the mind to that problem until they have seen it through. The man who gets somewhere has to learn to make his mind behave in the direction which it ought to take in order that he can persist in affairs that are vital to him and to others, no matter what drudgery is involved. The starting point in thinking deeply on matters away from the obvious is in deciding to give, at regular intervals, a few hours' concentrated attention on some special subject. The focusing of our minds intently on some predetermined goal or problem is a knack that can be acquired once a person has got hold of the idea. Carlyle said that "the weakest living creature, by concentrating his powers on a single objective, can accomplish something; whereas the strongest may fail to accomplish anything."

There is no recipe for thinking, no mental tabloids producing thought as opium produces visions. But there is a hygiene of the mind resulting in thought as inevitably as bodily hygiene results in health. At all times in the past thinking has been helped by a disgust for the trivial, a retirement from nonsense, and by commerce with superior intellects. At no period in the future will it be helped by different methods. A long process? No, the least investment is productive at once. An exacting one? No, distinction is far more enjoyable than commonness. Only try.

Is the effort worth while of doing some thinking away from the commonplace? People know that they ought to do a great deal better than they pretend to do. Granted a sound body, with normal sense organs, men can and should develop in accordance with their general intelligence, and this can be done through long practice in doggedly doing, along with that which is agreeable, a lot of things that are tiresome and monotonous, going out of our way, if necessary, to find them.

It is the moments when one gives up and goes down on the job that make the difference. Without doubt there is a great deal of habit in what we do—the habit of floating along or the habit of resisting. No one can live out a normal life without coming to moments that are very important, moments when it is going to make a lot of difference whether one hits with all he has or lets it slide. In a critical moment we have to decide whether to get drunk, whether to push for a better job, whether to tell a hard truth or an easy lie, whether to do something requiring great effort. The details may vary endlessly; but it is the same punch that takes us through. Having the habit of it will make it come easier. Most people become so much creatures of their habits that they are afraid to stir beyond them.

Farm Blacksmithing.

In setting up a blacksmith's shop on the farm an endeavour should be made to secure the best and most convenient position away from other outbuildings. Old iron and timber can be used for the walls, but a good roof should be erected, because tools which will be of great value will be kept in the shop.

In fitting out the shop there are some tools absolutely necessary, and continually being used, whereas others are called on only occasionally. The anvil and blower, vice, drilling machine, stocks and dies, hacksaws and punches are of great assistance in repairing the various machines and implements.

Most of these are frequently offered at sales, and usually can be purchased at a reasonable figure. To be fully equipped as a repair shop, the bush carpenter's shop should be amalgamated with that of the blacksmith. The majority of machines contain a proportion of woodwork, and it is useless to commence to overhaul without having a few of the most commonly used carpenter's tools close at hand.

An assortment of nuts, bolts, washers, &c., within reach, is also of great benefit. One should not attempt to repair a machine, knowing that the necessary bolts or the equivalent in the making are not on the spot.

Although only a few in number, one is amply repaid by having them handy and labour saved will more than account for the interest.

Unless the farmer has had a good deal of experience, no attempt should be made to do large and heavy jobs, or work that requires accurate setting. In the latter case the job might appear quite all right, but when set in position it will be found to have a decided wobble, consequently worn bearings will follow. Repairs such as those just outlined should go to the tradesman.

Apart from machinery and implements to be repaired, there are numerous other things that come quite within the province of the amateur. Of these, plough chains, if used, are one of the most important items to be kept in good order. Not only is it much better to have them minus so much wire, but by keeping them evenly repaired much will be done to minimise the risk of sore shoulders.—"The New Zealand Farmer."

Bureaucracy.

Mr. J. Pearce Luke, President of the Wellington (N.Z.) Chamber of Commerce, in his address at its annual meeting, surveyed the world position, and pointed out that the records of history show that in a general upward movement there have been periods of retrogression. Invariably these periods have developed nobler traits by reason of the discipline inseparable from the experiences of "hard times." . . . A war embittering the contending nations; a peace pact imposing such conditions that the principal contestants have been in economic thrall ever since, and over and above it all the merciless threat of bureaucracy. Bureaucracy has determined the bounds of national development, and unless and until it is swept away there cannot be real national or international progress."

Tomatoes—Picking and Packing Points.

Care should be taken when gathering tomatoes that they are not bruised, or they will decay rapidly. Tomatoes that are to travel long distances, or occupy days in transit, should be picked when they begin to colour at the blossom end, or even when they take on a light green colour.

When packing, the fruit should be graded according to size and ripeness, all in each package being as nearly alike as possible; the grading regulations in force provide for a variation of not more than 1 inch in the diameter of the fruits in any case.

The fruit will thus look better, sell better, keep better, and pack or travel better; the arrangement will be found advantageous to the buyer and more profitable to the seller, besides establishing a reputation for the brand amongst buyers. Each package must have the contents and quality faithfully marked on the outside, so that buyers may learn to rely on the brands without wanting to overhaul the fruit.

Culls should not be marketed, but fed to pigs or destroyed, as is done with other refuse fruit.

Seasonal Points in Poultry Management.

During the summer there are many factors which tend to make a difference in the returns from a poultry farm, and a great deal depends upon the efficiency of management as to whether egg production is satisfactory or not.

As far as the layers are concerned, close attention to feeding is necessary to ensure a seasonable continuity of production; faulty feeding methods are the reason why many poultry-farmers fail to secure the egg production they should during the summer and autumn. It will be found that during a hot spell the birds do not require as much food as usual, and unless judgment is exercised in feeding there is likely to be a sharp decline in the egg yield, due to the hens becoming surfeited with food, resulting in digestive derangement.

The wisest course to follow when a heat wave is expected is to reduce the usual quantity of food in accordance with the appetites of the birds, so that no food is allowed to lie around throughout the day. In fact, it is preferable to keep the birds rather keen for their meals, and when a cool change comes, gradually to increase to the normal quantity.

Strict attention should be paid to the watering arrangements to ensure that fresh water is provided and kept as cool as possible. Also that the water vessels are placed in close proximity to the houses; the birds should not have to traverse long distances during the heat of the day to obtain water, as this often leads to high mortality. Where automatic watering systems are fitted, care should be exercised to see that the vessels are kept clean and free from contamination by mash or other organic matter which may cause fermentation; this applies particularly where dry mash is fed.

On many poultry farms insufficient ventilation is provided during the summer time. It is quite common to see houses for both young stock and adult birds without an aperture along the top of the back wall under the roof to provide ventilation. This is due to the erroneous idea that an open-fronted house is sufficiently ventilated, but it should be understood that unless a current of air can pass through a house there will not be free circulation of the air. Moreover, by having a fair-sized aperture under the roof much of the heat reflected by the roof is carried off. The deeper the house, the larger the aperture required; it is a wise plan to have an adjustable shutter to open in the summer time and close in the winter.

Lack of ventilation is one of the causes contributing to an outbreak of catarrh (or "roup") among young stock, particularly towards the end of the summer when the humidity is high.—A. and P. Notes, N.S.W. Dept. Agric.

Grazing Lucerne.

Grazing lucerne with the dairy herd has one advantage and two drawbacks, when compared with the plan of cutting the crop and carting it to the cow pastures. The advantage lies in the saving of labour, and, when a considerable area has to be handled, this is an item of considerable importance. On comparatively small farms, where the owner and his family do most of the work, cutting and carting the lucerne is undoubtedly the most economical plan.

The drawbacks to grazing are the shortening of the life of the stand and the necessity of more cultivation with the object of keeping down weeds, which take possession more quickly when the lucerne is grazed than when it is constantly cut, and there is the risk of loss from bloating. When the lucerne is cut there is no waste of material, but when grazed there is considerable waste through the trampling of the cows.

Whether the lucerne is grazed or cut, the land must be thoroughly cultivated at least once each season, in order to keep down weeds and stimulate the growth of the lucerne plants; but, as previously stated, more cultivation is required when the crop is grazed than when it is cut, for the reason that, in the former case, the weeds are rejected by the cows, and have an opportunity of spreading; while, in the latter case, lucerne and weeds are both cut down regularly and removed to the pasture before they have time to ripen their seeds.

It is considered a mistake to graze the first growth of the young lucerne, but I see no reason why the cows should not be turned in to pick up the cut material, provided they are not allowed to stay too long and injure the young shoots of the second growth. When lucerne is cut and carted to the pastures, it should be cut to-day and carted to-morrow.—Primrose McConnell in "The New Zealand Farmer."

Pasture Improvement Increases Production.

If any further evidence were required of the value of pasture improvement on coastal dairy farms it was provided by the past season's production figures at Berry Experiment Farm (N.S.W.). The total production was 8,910 lb. milk testing 4.22 per cent., averaging 376 lb. butter-fat per cow for the year ended 30th June last. Compare these figures with those for the year ended 30th June, 1927, before pasture improvement work was undertaken seriously. In that year total production was 7,562 lb. milk of 3.6 per cent. test, average 272 lb. butter-fat per cow.

It is of more than passing interest to know that last year's production figures include those of many heifers which are the progeny of the first animals reared on the treated pastures at Berry Farm, and which show a notable improvement in both appearance and production.

The Holstein as a Milk Producer.

Weight in Holstein dairy cows should not be mistaken for beef type, writes Dr. H. Epstein, D.Agr., a South African authority. No Holstein breeder wants beef, but he wants heavy, large-framed animals. He wants these, not because they carry large quantities of flesh, but because they are the biggest and most economical milk producers.

One of the world's biggest Holstein cattle breeders' associations has compared the records of a large number of its highest producers to their body weights with the following result:—

Average Live Weight Per Cow.	Average Milk Production.
Over 1,540 lb.	20,880 lb.
1,430-1,540 lb.	19,745 lb.
1,320-1,430 lb.	20,024 lb.
Under 1,320 lb.	17,668 lb.

The heavier cows have proved superior to the lighter ones as far as milk production is concerned, a fact which has been experienced in the United States as well.

But the heavier cow also needs less feeding for a certain amount of milk, a point which should be of the greatest interest to dairymen. One hundred pounds weight of starch equivalent enabled cows of—

Over 1,540 lb. to produce 202.4 lb. milk.
1,430-1,540 lb. to produce 204.3 lb. milk.
1,320-1,430 lb. to produce 200.9 lb. milk.
Under 1,320 lb. to produce 177.6 lb. milk.

Holsteins of the heavy type are, according to these extensive tests, not only the biggest, but also the most economical producers. In other words, the light, fine, old-fashioned dairy type in Holsteins is uneconomical in comparison with the heavy, strong, broad and deep-set modern dairy type.

To Protect Haystacks against Mice.

Many devices have come under notice from time to cope with the mice pest in relation to haystacks, observes a departmental publication. Building the stack upon a raised platform answers the purpose, if the blocks upon which the platform is built are capped with galvanised-iron guards or inverted petrol tins so as to prevent the mice reaching the platform boards. Another successful method of keeping them out is to enclose the stack with a fence of galvanised iron, either plain or corrugated, about 2 feet high. Let the iron into the ground to a depth of 4 inches, and place it in a slanting position, leaning outwards, all round the stack; take care to leave no open space at the corners. To ensure that mice do not enter a stack thus protected, care should be taken that straws, bags, or other articles are not allowed to hang from the iron fence or from the raised platform.

If it should be found that mice are troublesome in the stack, poison with arsenic dissolved in water. Place dishes of the solution all round the stack; if it will not entirely eradicate the pest, this method will help to keep it in check.

Proper precautions should, of course, be taken in using the above, as in the case of any other poison.—Ag. and P. Notes, N.S.W. Dept. Agric.

How long to Milk a Cow.

The number of cows which can be milked in an hour is a problem which appears to have puzzled people of all classes except those who have actually milked cows, to whom the matter is so simple.

The factors which control the number of cows which can be milked per hour are many and varied. The time of the year, the amount of milk produced, the ease or otherwise with which the milk can be drawn, and, of course, the skill of the milker vitally affect the situation. In the month of May, when in Cheshire and Shropshire the cows go out to grass, with probably a percentage of first-calf heifers with short teats among them, a very general number of cows for each milker is eight.

With average cows you have to slip along to get these milked and dripped within the hour, but it can generally be done when there is a fête or some other attraction ahead. Exceptionally good milkers could possibly milk twelve such cows in the hour, but it would hardly be a matter of ease.

There are short-teated heifers sometimes which would take up to fifteen minutes for the best of milkers to milk out clean, and there are nice easy cows from which a bucketful can be extracted in four or five minutes.

As the year advances and the cows drop off their milk, the number which can be milked in the hour naturally increases, and later on it would be no hardship or difficulty to milk fourteen in the hour.

With regard to the question, Is quick milking always thorough milking? Unfortunately, it is not. When it is thorough and clean, quick milking undoubtedly obtains the best results.—A. J. Lee in the "Livestock Journal" (England).

Pigs and Pork—What the Market Demands.

Mr. Charles Binnie, president of the Stockowners' Association of New South Wales, during his recent visit to England, made close inquiry into the pork and bacon trade of the United Kingdom, and has supplied us with some particulars which again confirm the conflicting requirements of the local and English markets as regards bacon. Mr. Binnie noticed in the retail shops that the "streaky" bacon that is generally fancied in Australia was the cheapest, being priced at about 9d. per lb., whereas the heavily-fatted cuts from the gammon and back were most in demand, and ranged in price up to 14d. per lb. Bacon or pork from Tamworth pigs was not favoured, that from the Large White being most sought after by the trade.

The differing tastes of the two countries is accountable for to a great degree by their dissimilar climatic conditions, the colder English climate favouring the consumption of comparatively fat bacon. Under the circumstances, it would appear that to meet the demands of both the overseas and local markets the pig-breeder in this country would have to raise two distinct types of baconers. At any rate, the Australian trade is at present well served by the Tamworth-Berkshire cross, bred back to the Berkshire or Tamworth.

The issues in connection with the pork export trade are not so confusing, although, as Mr. Binnie points out, the carcass most favoured is one between 70 and 80 lb. Maize-fed pork is not favoured in England, the fat being considered "tallowy." Pork from pigs fed on peas, beans, barley, or wheat, however, is quite acceptable to the trade. Mr. Binnie draws particular attention to the potentialities of wheat feeding for pork production, and suggests that pig breeding and fattening might, with profit, develop into more than a sideline with wheatgrowers, who, he claims, could get a return of 5s. a bushel for their wheat by marketing it "through" the pig.—"Agricultural Gazette" of New South Wales.

Maize Cultivation.

Harrowing the young maize crop is a very efficient means of killing young weeds, conserving moisture, and aerating and warming the soil to give the young plants a quick start. Deep cultivation may be practised in the early stages of growth, but as the roots spread shallow cultivation should be practised.

Where weeds cannot be controlled by other cultural operations, hilling may be necessary to check and smother weed growth. Hilling as a practice in cultivation cannot be recommended. Hilling with the plough is not generally advisable owing to the unavoidable destruction of roots, which gives the crop a setback.

The main object of all cultivation should be to keep down weeds.

White Hide—The Alum Tanning Process.

The following directions for the making of white hide are given by the lecturer in charge, Sydney Technical College Tanning School, in the "Agricultural Gazette" of New South Wales.

1. Soak the hide in clean water for four hours, then run off the dirty water and cover with clean water; leave for twenty-four hours. This should be sufficient for fresh or salted hides. Dry hides should be soaked for a further twenty-four hours, or until they are soft.

2. Remove the hair by soaking hides in milk of lime—30 lb. of lime per 100 gallons of water. Handle each day, and leave until the hair can be removed—about six to seven days in summer.

3. Remove all flesh and fat by scraping with a knife. Wash well with several lots of water during the twenty-four hours after removing the hair and pieces of flesh, fat, &c.

4. Tan in a solution of alum (5 lb.), salt (1½ lb.), Glauber salt (1½ lb.), and water (10 gallons). Use enough of the solution to cover the hides. Handle twice daily, and allow six days for tanning.

5. Drain well from the alum and salt solution, but do not wash; then cover both sides with fish oil or neatsfoot oil and hang up and allow to dry slowly. Tanners have a machine for forcing the oil fats, &c., into the hide.

6. When dry, stretch until soft. If dry skins are difficult to stretch, sprinkle with water and cover for two days; again stretch and dry.

Alum-tanned leather is sometimes covered with a paste instead of oil before drying. The paste is made up as follows:—

5 lb. flour,
2½ lb. alum,
1 lb. salt,
1 lb. neatsfoot oil,
1 to 1½ gallons water.

Mix the alum and salt with water and then the flour and oil in a separate basin. Add to the flour and oil sufficient of the alum and salt solution to make a paste. Put the hide and paste into a tub, and handle the hide vigorously so as to force the paste into the leather. Hang the leather up and allow it to dry slowly without removing the paste. If the leather is too firm, rub on more fat, such as soft dripping, &c. If possible, stretch the leather just before it is quite dry. After stretching, it can be nailed on a wall or similar surface.

Bees and Fruit—A Profitable Combination.

Heavy losses are sustained annually by fruit-growers as a result of their trees not bearing well, which in many cases is due to defective pollination of the flowers of the trees, runs an article in the "Agricultural Gazette" of New South Wales. Investigations have shown that insects play an important role in the pollination of flowers, and in this regard there is none more industrious than the honey bee. If it were possible for human hands to do what the bee does, it is safe to predict that the owner of those hands would commercialise his ability and command a substantial wage. That the bee does it for nothing and is therefore neglected only goes to prove the old saying that what you get for nothing is often valued at cost price.

Of all the insects that visit flowers the highest frequency belongs to bees, though there are other insects, such as the Syphrid flies, small beetles, &c., that assist in the transference of pollen from one flower to another. The bee is, however, the best equipped for this function. Inside the flower, nectar is secreted, and this attracts the insect, which, while crawling about within the flower in search of the nectar, accumulates pollen on its hairy body, and when it settles on another flower some of the pollen is bound to adhere to the sticky pistil of that flower. It has been shown that by placing a beehive in an orchard during the flowering season it is possible to enhance the fruit crop, even though the orchard may be in a fruit area famed for the production of good crops in normal seasons, and it has also been shown that the trees nearest to the hive bear the best crops.

The distance the pollen can be carried and the number of flights made by each bee will depend on weather conditions and the size of the swarm. On warm, sunny days the bees are more active than during cold or cloudy weather.

Experiments in other countries and experience in this country have shown that even with cold weather during the flowering season the trees nearest the hives bear better than those farther away. Thus, the greatest distance to which "suitable" pollen can be carried from its source to the trees to be fertilised is determined by the nature of the seasons. "Suitable" pollen is that which will produce good results after pollination. For example, the pollen of certain tree varieties will only be suitable for certain other varieties, e.g., certain apple varieties for other apples, as is also the case with pears, plums, strawberries, and almonds.

Discussing this subject, a South African authority recommends that bees be kept at the rate of one strong colony, or, where possible, two colonies to the morgen (about two-thirds of an acre). The hives should be moved about in the orchard during the flowering season, and removed thereafter.

QUEENSLAND RECORD IN BACON PIG SLAUGHTER.

To have slaughtered more than a million bacon pigs and to have supervised the slaughter of several millions more, is the record of Mr. Sam Mison, the veteran foreman of J. C. Hutton's bacon factory at Zillmere. It is certainly a Queensland record, and may be a world record.

Born in Gibralter in 1869, Mr. Mison landed in Queensland with his parents some six years later. His parents were among the first settlers at Lutwyche where, for many years, his father was engaged in brickmaking. Sam's first job was carting bricks to the Brisbane Grammar Schools and Boggo Road Gaol. Always interested in pigs, Sam's first outside experience in slaughtering was at the co-operative slaughter yards at the Grange, then known as Mooney's yards. While thus engaged, this energetic youth attracted the attention of J. C. Hutton's, who were then located in the Valley, and Sam's job was washing bacon and hams in the process of curing.

There were few pigs bred in Queensland for the bacon trade in those early days, most of the supply coming from Melbourne and New Zealand. The late Mr. John Reid, for half a century prominent in the Queensland bacon trade, just about that time located the site at Zillmere where the factory still stands and purchased the property from Mr. John Lees. This was about 1889, and shortly afterwards Sam was engaged as slaughterman, and carried on this work for two years or more. He felt he would like to see more of the world, so resigned and moved north as far as Burketown, where as a brickmaker he prepared bricks for a large boiling-down works at that centre. Thence he returned to Brisbane and was engaged by the Hollandier Meat Company, owned by Mr. William Dobbyn.

A breakdown in the machinery threw Sam on the labour market until the keen-eyed John Reid again secured his services in March, 1894, and from that day to this Sam has been in the employ of the old firm.

In those days, of course, the method of treating pigs was different to the modern method now in use, and a man would kill a number of pigs, pass them on to the scalding tank, and help with the cleaning and dressing, which was all done by hand, and would take a full day to get through the number the dehairing machine now does in an hour.

It was while thus engaged in later years with the machines that Mr. Reid remarked to Mison that he thought he should be ashamed to look a pig in the face, seeing that on that day he had slaughtered his millionth pig.

For over twenty-five years Sam slaughtered between 60,000 and 70,000 pigs per annum. After the death of Mr. Frank Weston in 1915, who was then foreman of the works, he was appointed to that position and has held the important post until now. Sam well remembers the days when the farmers from the Dayboro and surrounding district would leave home the night before pig slaughter day with their German wagons to cart their pigs to Zillmere. They are now delivered by train and motor lorry.

Sam still carries on the good work and has a wide circle of friends in the business and social world of the district in which he resides, and is ever willing to lend a helping hand in any movement aiming at progress and improvement of the conditions of the man on the land.

—E. J. SHELTON, Senior Instructor in Pig Raising.

PLATE 23.
Entrance to Gorge, Carnarvon Range, Queensland. Note the peculiar rock formation on the right suggestive of a rugged human face.

PLATE 24.
Looking up Mooleyamba Creek from the first crossing, Carnarvon Range, Queensland.
[*Photos.: J. L. Bowman, Dept. Agriculture and Stock, Brisbane.*

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable cases of infant mortality.

HOLIDAY TRAVELLING.

TRAVELLING with a baby and several small children is no holiday for their mother. Unless she plans everything carefully beforehand a long train journey may end with an exhausted mother and a handful of cross, tired, over-fed children, who will be sick for the next few days. Perhaps a little advice at this season of the year may be helpful.

Food.

It is most important that this should be carefully considered beforehand. The breast-fed baby, who has been properly managed should give no trouble at all. But it is not so with the bottle-fed infant. We have seen many who have been seriously upset by milk which has gone bad in the train, especially in hot weather. It is true that there are ways of carrying the baby's milk safely. But these require so much care and understanding, and the consequences of any mistake may be so serious, that we cannot advise them. Nor can we advise the mother on a journey to buy milk at the railway stations. Much the safest plan is to carry a supply of good dried milk (Glaxo or Lactogen) not, of course, dried skimmed milk. Boiling water is always procurable, and it may also be carried in vacuum flasks, so that it is always possible to scald the bottles and teats, and to make up the feeds for each meal. Any milk left after a feed should be thrown out at once, never left in the bottle. It is well to carry more than one bottle and teat. These should be wrapped in clean boiled butter muslin and carefully packed in a tin. Though the baby may not be used to dried milk, it will do him no harm, provided it is not made too strong. It will be wise to make it up rather weaker than advised on the tin. At the end of the journey, when good fresh milk is procurable, he will soon make up for having been on a rather weak mixture for one or two days.

For the toddlers avoid bought foods, cakes, and sweets, which may do him much harm, especially as the novelty and excitement will very probably have weakened his digestion. Remember that a day of rather short rations will do him no harm, but a day of over-feeding may go a long way to spoil his holiday and your own too. Carry your own provisions. Pack a tin with some slices of baked bread and oatcake, which may be ready buttered, and some sandwiches, preferably of brown bread. These may contain lettuce, sliced tomatoes, egg, either sliced or scrambled, or soft cheese spread on butter, or marmite. Add a few dates and raisins, apples, and oranges, and you have all the solid food necessary. He may drink dried milk dissolved in hot water, like his baby brother, or you may carry one or two lemons with a small packet of sugar, which will make a drink he will surely relish. Let him have his little picnics at the right times, but don't try to keep him quiet by feeding him all the time. You won't succeed, it will only make him cross and irritable, miserable himself, and a torment to others. But let him have a drink of water when he wants it.

Amusement.

Most children will be interested in looking out of the window until they are tired, but don't let them tumble out. It may be well to carry a few simple toys and picture books and writing pad and a pencil.

Clothing.

You won't need to carry much wraps in the summer, but a light rug and cushion will be useful. For the baby have a plentiful supply of napkins, and some old newspapers or a mackintosh bag for the wet napkins.

Rest and Sleep.

These are important if over-fatigue and fretfulness are to be avoided. A dress-basket is most useful for a young baby. Properly managed he will sleep or lie awake in this quite contented, and much happier than if constantly nursed in the arms of an over-heated and exhausted mother.

If you have trained your children well you will reap your reward when travelling. How sad it is to see children in the train scrambling over everything, eating an endless supply of cakes and sweets, grubby and tired, ignoring their mother's efforts at control, and finally fretful and crying from sheer exhaustion and discomfort.

COUNTRY WOMEN'S CLUB WORK.

Writing in the Agricultural Bureau Record (New South Wales), Miss Lorna Byrne, B.Sc.Agr., Assistant Organiser of Women's Branches of the Bureau, makes the following useful suggestions for country women's organisations:—

DURING the past year a considerable number of branches have formed special women's committees, which are apparently functioning with much success. Other branches are considering this activity, but some of them still seem to be somewhat in doubt as to how the work of the women in this direction might be carried out.

There are already several women's clubs and they are doing excellent work, but there is sometimes a tendency, when a club is formed, for it to become almost a separate women's organisation. Should this occur it would be very undesirable, as there is already one important women's organisation—the Country Women's Association—which is doing wonderful work amongst the women of the State, and it would be regrettable if we created any overlapping.

The ideal branch is the one which arranges that the men and women shall meet together on the majority of occasions for talks, demonstrations, debates, and social activities which are of common interest, but there are obviously occasions on which the subjects of most interest to the men would be of little concern to the majority of the women in the branch. It is then desirable that the women's committee should take charge of the women present at that particular meeting.

I have often been asked, "What can we do at such a women's meeting?" I would like to suggest that the knowledge of the women in the district should be organised through this committee and made available to other women members. It is a very good plan to make a list of the women members and then to ask the question, "Who does what well?" It is quite easy then to find the women who are most qualified to deal with certain topics of interest. For instance, one woman is probably more expert than some of the others in the art of flower gardening. It would be very useful then, if on one occasion, she would take the women members through her garden and discuss with them the methods of preparation of the beds, the propagation of plants and the conservation of moisture in the soil. Another woman probably has had experience in dressmaking and millinery and a "renovation afternoon" might well be recommended under her guidance. Sometimes again, a demonstration in the kitchen by a member on preserving of fruits, making of pulp, uses of dried fruits, sweet-making, cake decorating, and allied subjects would be found very helpful to a number of the members. So one could go on enumerating the very many topics of direct concern to the majority of the members of women's sections, which could effectively be discussed, by individuals who have either, through longer experience, or more expert training, gained more information on certain subjects than other women have been able to do.

Apart from household matters, one might suggest that doctors, dentists, nurses, and officials of the Railway and Health Departments, as well as ambulance officers might well be invited to visit the branches and discuss such matters as health, home-nursing, care and development of the teeth and first aid. Already numbers

of addresses and demonstrations have been given by the courtesy of these professional people, and they have proved invaluable in spreading the propaganda of good health among many of our members.

In regard to first aid, some of the branches have been a little inclined to shun such a topic, thinking that it would be necessary for members to carry out a full course, and this, I consider, would be rather difficult for the majority of our Bureau branches. At the same time a knowledge of what to do in case of accident—for example, a knowledge of the arresting of bleeding, the making of an improvised stretcher, the temporary setting of a broken bone, the treatment of snake-bite and antidotes for poisons—is absolutely necessary for the majority of people who live in the country, so that talks and demonstrations on these matters can well be recommended, even though a full course with the necessary examination for a first aid certificate may not be practicable. I would like to suggest also that every branch should endeavour to include in its library a first-aid handbook.

CITRUS FRUITS IN THE KITCHEN.

Orange Delight.—Peel and remove the pith of six oranges. Slice thinly in rings, removing the seeds. Arrange in a glass dish or a pyrex, and sprinkle with sugar. Pour a rich boiled custard over the top. Make a meringue with the whites of eggs and head it on top of custard, then garnish with grated orange peel. Set meringue in oven; stand the glass in pan of water while in the oven.

Orange Quarters.—Take three oranges, ½ teaspoon citric acid or juice of two lemons, 2 cups hot water, 1 tablespoon brandy or sherry, little cochineal, and 3 dessertspoons gelatine. Cut oranges in halves, scoop out centre, leaving only the skins; do not break them. Dissolve gelatine, sugar in hot water, add acid or lemon juice, sherry or brandy, and colour half the mixture with a few drops of cochineal. When cool pour mixture into shells or skins, and allow to set. Serve on a bed of green leaves.

Orange Compote.—Take ⅓ pint of water, ¼ lb. sugar, and six oranges. Peel oranges, divide into sections, boil sugar and water with shreads of orange peel. Take out the peel and put the orange sections in the syrup and simmer gently ten minutes. Take out and arrange in a glass dish. Add a couple of sheets of gelatine dissolved in water to the syrup and allow syrup to cool a little; then pour over the oranges.

Lemon Trifle.—Items required are 3 cups water, 1½ cups sugar, juice and rind of two lemons, 2 tablespoons arrowroot, and whites of two eggs. Boil the water, sugar, and lemon juice together, then add the blended arrowroot, and when cooked add the stiffly-beaten whites. Serve cold with custard made from yolks.

Orange or Lemon Shape.—Take 3 eggs, ½ oz. gelatine, 2 oz. sugar, cup of hot water, rind of a lemon grated, and juices 2 oranges or lemons. Soak gelatine in hot water, whip whites of eggs till stiff; gradually pour on gelatine and water, beating all the time, beat yolks and add sugar, beat all together. Pour into a wet mould till set.

Orchard Notes for February.

THE COASTAL DISTRICTS.

FEBRUARY in coastal Queensland is frequently a wet month, and, as the air is often heavy with moisture and very oppressive, plant growth of all kinds is rampant, and orchards and plantations are apt to get somewhat out of hand, as it is not always possible to keep weed growth in check by means of cultivation. At the same time, the excessive growth provides a large quantity of organic matter which, when it rots, tends to keep up the supply of humus in the soil, so that, although the property looks unkempt, the fruit-producing trees and plants are not suffering, and the land is eventually benefited. When the weed growth is excessive and there is a danger of the weeds seeding, it is a good plan to cut down the growth with a fern hook or brush scythe and allow it to remain on the ground and rot, as it will thereby prevent the soil from washing, and when the land is worked by horse power or chipped by hand it will be turned into the soil. This is about the most satisfatcory way of dealing with excessive weed growth, especially in banana plantations, many of which are worked entirely by hand.

The main crop of smooth-leaf pineapples will be ready for canning, and great care must be taken to see that the fruit is sent from the plantation to the cannery with the least possible delay and in the best possible condition. The only way in which the canners can build up a reputation for Queensland canned pineapples is for them to turn out nothing but a high-class article. To do this they must have good fruit, fresh, and in the best of condition.

The fruit should be about half-coloured, the flesh yellowish, not white, of good flavour, and the juice high in sugar content. Over-ripe fruit and under-ripe fruit are unfit for canning, as the former has lost its flavour and has become "winey," while the latter is deficient in colour, flavour, and sugar content.

For the 30 or 32 oz. can, fruit of not less than 5 in. in diameter is required, in order that the slices will fit the can; but smaller fruit, that must not be less than 4 in. or, better still, 4½ in. in diameter, and cylindrical, not tapering, can be used for the 20-22 oz. can.

Bananas for shipment to the Southern States should on no account be allowed to become over-ripe before the bunches are cut; at the same time, the individual fruit should be well filled and not partly developed. If the fruit is over-ripe it will not not carry well, and is apt to reach its destination in an unsaleable condition.

Citrus orchards require careful attention, as there is frequently a heavy growth of water shoots, especially in trees that have recently been thinned out, and these must be removed. When there are facilities for cyaniding, this is a good time to carry out the work, as fruit treated now will keep clean and free from scales till it is ready for market. Citrus trees can be planted now where the land has been properly prepared, and it is also a good time to plant most kinds of tropical fruit trees, as they transplant well at this period of the year.

A few late grapes and mangoes will ripen during the month, and, in respect to the latter, it is very important to see that no fly-infested fruit is allowed to lie on the ground but that it is gathered regularly and destroyed. Unless his is done, there is every probability of the early citrus fruits being attacked by flies bred out from the infested mangoes.

Strawberries may be planted towards the end of the month, and, if early ripening fruit is desired, care must be taken to select the first runners from the parent plants, as these will fruit quicker than those formed later. The land for strawberries should be brought into a state of thorough tilth by being well and deeply worked. If available, a good dressing of well-rotted farmyard manure should be given, as well as a complete commercial fertilizer, as strawberries require plenty of food and pay well for extra care and attention.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELAND.

THE marketing of later varieties of peaches and plums and of mid-season varieties of apples and pears, as well as of table grapes, will fully occupy the attention of fruitgrowers in the Granite Belt, and the advice given in these notes for the two previous months with regard to handling, grading, packing, and marketing

is again emphasised, as it is very bad policy to go to all the trouble of growing fruit and then, when it is ready to market, not to put it up in a way that will attract buyers.

Extra trouble taken with fruit pays every time. Good fruit, evenly graded and honestly packed, will sell when ungraded, and badly packed fruit is a drug on the market. Expenses connected with the marketing of fruit are now so high, owing to the increased cost of cases, freight, and selling charges, that it is folly to attempt to market rubbish.

During the early part of the month it will be necessary to keep a careful watch on the crop of late apples in order to see that they ore not attacked by codlin moths. If there is the slightest indication of danger, a further spraying with arsenate of lead will be necessary, as the fruit that has previously escaped injury is usually that which suffers the most.

Fruit fly must also be systematically fought wherever and whenever found, and no infested fruit must be allowed to lie about on the ground.

Grapes will be ready for market, and in the case of this fruit the greatest care in handling and packing is necessary. The fruit should never be packed wet, and, if possible, it is an excellent plan to let the stems wilt for a day at least before packing. This tends to tighten the hold of the individual berries on the stem and thus prevent their falling off.

In the western districts winemaking will be in progress. Here again care is necessary, as the better the condition in which the fruit can be brought to the press the better the prospect of producing a high-class wine.

Where necessary and possible citrus trees should be given a good irrigation, as this will carry on the fruit till maturity, provided it is followed up by systematic cultivation so as to retain a sufficient supply of moisture in the soil.

Farm Notes for February.

REFERENCE was made in last month's Notes to the necessity for early preparation of the soil for winter cereals, and to the adoption of a system of thorough cultivation in order to retain moisture in the subsoil for the use of crops intended to be raised during the season. The importance of the subject, and its bearing in relation to prospective crop yields, is made the excuse for this reiteration.

Special attention should be given to increasing the area under lucerne (broadleaf Hunter River) wherever this valuable crop will grow. Its permanent nature warrants the preparation of a thorough tilth and seed bed, and the cleansing of the land, prior to sowing the seed, of all foreign growths likely to interfere with the establishment and progress of the crop. Late in March or early in April is a seasonable period to make the first sowing providing all things are favourable to a good germination of seed.

Dairymen would be well advised to practise the raising of a continuity of fodder crops to meet the natural periods of grass shortage, and to keep up supplies of succulent fodder to maintain their milch cows in a state of production.

Many summer and autumn growing crops can still be planted for fodder and ensilage purposes. February also marks an important period as far as winter fodder crops are concerned, as the first sowings of both skinless and cape barley may be made at the latter end of the month in cool districts. Quick-growing crops of the former description, suitable for coastal districts and localities where early frosts are not expected, are Soudon grass, Japanese and French millet, white panicum, liberty millet, and similar kinds belonging to the Setaria family. Catch crops of Japanese and liberty millet may also be sown early in the month in cooler parts of the State, but the risk of early frosts has to be taken.

Maize and sorghums can still be planted as fodder and ensilage crops in coastal districts. In both coastal and inland areas, where dependence is placed largely on a bulky crop for cutting and feeding to milch cows in May and June, attention should be given to Planters' Friend (so-called Imphee) and to Orange cane. These crops require well-worked and manured land; the practice of broadcasting seed for sowing at this particular season encourages not only a fine stalk but a density of growth which in itself is sufficient to counteract to some extent the effect of frost.

In most agricultural districts where two distinct planting seasons prevail, the present month is an excellent time for putting in potatoes. This crop responds to good treatment, and best results are obtainable on soils which have been previously well prepared. The selection of good "seed" and its treatment against the possible presence of spores of fungoid diseases is imperative. For this purpose a solution of 1 pint of formalin (40 per cent. strength) to 24 gallons of water should be made up, and the potatoes immersed for one hour immediately prior to planting the tubers. Bags and containers of all kinds should also be treated, as an additional precaution. "Irish Blight" has wrought havoc at times in some districts, and can only be checked by adopting preventive measures and spraying the crops soon after the plants appear above the ground. Full particulars on the preparation of suitable mixtures for this purpose are obtainable on application to the Department of Agriculture, Brisbane.

Weeds of all kinds, which started into life under the recent favourable growing conditions, should be kept in check amongst growing crops; otherwise yields are likely to be seriously discounted. The younger the weeds the easier they are to destroy. Maize and other "hoed" crops will benefit by systematic cultivation. Where they are advanced, and the root system well developed, the cultivation should be as shallow as possible consistent with the work of weed destruction.

First sowings may now be made of swede and other field turnips. Drilling is preferable to broadcasting, so as to admit of horse-hoe cultivation between the drills, and the thinning out of the plants to suitable distances to allow for unrestricted development. Turnips respond to the application of superphosphate; 2 cwt. per acre is a fair average quantity to use when applied direct to the drills.

Where pig-raising is practised, land should be well manured and put into good tilth in anticipation of sowing rape, swedes, mangels, field cabbage, and field peas during March, April, and May.

PLATE 25.

Lake Nuga-Nuga, covering a drowned forest resulting from the overflow of Mooleyamba Creek at Warranilla, below the head of the Browne River, a tributary of the Dawson.

[*Photo.: Mr. J. L. Bowman.*

CLIMATOLOGICAL TABLE—NOVEMBER, 1933.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·84	86	73	89	23	71	8, 9, 15, 17, 21, 24, 25, 29	245	8
Herberton	..	79	61	87	22	54	16	601	14
Rockhampton	29·95	82	67	91	23	61	13	514	12
Brisbane	30·03	77	63	84	26	58	3	841	19
Darling Downs.									
Dalby	29·99	79	60	87	3	50	2	716	15
Stanthorpe	..	72	53	80	2, 3	47	3	541	17
Toowoomba	..	73	57	85	3	51	3	845	21
Mid-interior.									
Georgetown	29·86	94	64	99	2	53	1	796	7
Longreach	29·88	90	66	99	25	60	12	624	12
Mitchell	29·94	80	62	92	3	49	10	793	14
Western.									
Burketown	29·84	93	74	100	22	67	13	46	1
Boulia	29·84	95	69	107	17	59	21	102	4
Thargomindah	29·89	87	67	105	1	56	10	216	6

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF NOVEMBER, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING NOVEMBER, 1933, AND 1932, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Nov.	No. of Years' Records.	Nov., 1933.	Nov., 1932.
North Coast.	In.		In.	In.
Atherton	2·19	32	5·14	0·27
Cairns	3·75	51	14·04	1·68
Cardwell	4·00	61	11·48	1·75
Cooktown	2·56	57	2·45	0·93
Herberton	2·49	47	6·01	0·07
Ingham	3·65	41	13·81	5·16
Innisfail	6·06	52	23·65	1·56
Mossman Mill ..	4·06	20	9·50	1·73
Townsville	1·82	62	5·86	1·98
Central Coast.				
Ayr	1·63	46	5·02	1·48
Bowen	1·25	62	3·57	0·13
Charters Towers ..	1·45	51	2·92	1·32
Mackay	2·99	62	13·65	1·39
Proserpine	2·65	30	10·81	0·99
St. Lawrence ..	2·27	62	7·89	0·85
South Coast.				
Biggenden	2·72	34	5·80	1·16
Bundaberg	2·44	50	6·66	0·56
Brisbane	3·78	82	8·41	2·84
Caboolture	3·39	46	8·30	2·44
Childers	2·66	38	7·82	1·60
Crohamhurst	4·34	40	11·89	4·64
Esk	3·19	46	7·44	3·75
Gayndah	2·90	62	6·38	5·31
Gympie	3·13	63	9·77	1·74
Kilkivan	2·55	54	4·50	1·77
Maryborough ..	3·11	61	8·84	1·86
Nambour	3·76	37	14·87	2·67
Nanango	2·63	51	6·87	3·12
Rockhampton ..	2·35	62	5·14	4·31
Woodford	3·17	46	7·13	1·41

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Nov.	No. of Years' Records.	Nov., 1933.	Nov., 1932.
Central Highlands.	In.		In.	In.
Clermont	1·98	62	7·60	2·04
Gindie	2·02	34	0	3·84
Springsure	2·10	64	6·72	2·61
Darling Downs.				
Dalby	2·71	63	7·16	3·76
Emu Vale	2·69	37	6·19	3·53
Hermitage	2·65	27	0	4·39
Jimbour	2·42	45	7·84	3·67
Miles	2·49	48	9·05	3·21
Stanthorpe	2·72	60	5·41	3·10
Toowoomba ..	3·29	61	8·45	5·09
Warwick	2·63	68	5·45	5·82
Maranoa.				
Roma	2·11	59	3·29	4·34
State Farms, &c.				
Bungeworgorai ..	2·13	19	0	4·14
Gatton College ..	2·80	34	11·15	4·81
Kairi	2·16	19	4·88	0·06
Mackay Sugar Experiment Station	2·64	36	11·82	2·02

GEORGE G. BOND, Divisional Meteorologist.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

MOONRISE.

	January. 1934.		February. 1934.		Jan. 1934.	Feb. 1934.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	5·0	6·50	5·24	6·46	7·17	7·40
2	5·1	6·50	5·25	6·45	8·0	8·10
2	5·2	6·50	5·26	6·44	8·27	8·38
4	5·2	6·50	5·27	6·44	9·8	9·9
5	5·3	6·50	5·28	6·43	9·37	9·41
6	5·3	6·50	5·29	6·43	10·6	10·15
7	5·4	6·51	5·30	6·42	10·35	10·57
8	5·5	6·51	5·30	6 42	11·7	11·47
9	5·6	6·51	5·31	6·41	11·38	..
					a.m.	a.m.
10	5·6	6·51	5·32	6·41	..	12·47
11	5·7	6·51	5·32	6·40	12·17	1·51
12	5·8	6·51	5·33	6·40	1·4	3·0
13	5·9	6·51	5·34	6·39	2·0	4·11
14	5·10	6·51	5·34	6·39	3·2	5·23
15	5·11	6·51	5·35	6·38	4·12	6·30
16	5·12	6·52	5·36	6·38	5·26	7·34
17	5·13	6·52	5·36	6·37	6·39	8·37
18	5·13	6·52	5·37	6·36	7·48	9·37
19	5·14	6·52	5·37	6·35	8·52	10·36
20	5·15	6·52	5·38	6·34	9·54	11·36
						p.m.
21	5·15	6·52	5·38	6·33	10·53	12·32
22	5·16	6·52	5·39	6·32	11·53	1·28
					p.m.	
23	5·16	6·52	5·39	6·31	12·41	2·22
24	5·17	6·51	5·40	6·30	1·47	3·11
25	5·18	6·51	5·41	6·29	2·42	3·35
26	5·19	6·50	5·43	6·27	3·36	4·36
27	5·20	6·50	5·44	6·26	4·27	5·9
28	5·20	6·49	5·45	6·25	5·15	5·42
29	5·21	6·49	..	..	5·59	..
30	5·22	6·48	..	..	6·37	..
31	5·23	6·47	..	..	7·10	..

Phases of the Moon, Occultations, &c.

1 Jan.	○	Full Moon	6 54 a.m.
9 ,,	☽	Last Quarter	7 36 a.m.
15 ,,	●	New Moon	11 37 p.m.
22 ,,	☾	First Quarter	9 50 p.m.
31 ,,	○	Full Moon	2 31 a.m.

Perigee, 15th January, at 11.12 a.m.
Apogee, 28th January, at 5 a.m.

Jupiter rises at 2.1 a.m. on the 1st and at 1.13 a.m. on the 15th.

Saturn sets at 10.57 p.m. on the 1st and at 10.4 p.m. on the 15th.

At Brisbane—The Southern Cross does not come into view until about 11 p.m. on the 1st, low down in the S.S.E., head slanting downwards. Near the end of the month it may be seen in this position about 9 p.m. At Christmas time the Cross is noticeably absent during the evening hours.

Mercury will pass from Libra into Scorpio between the 1st and 15th; on the 14th it will be within half a degree of Beta Scorpii.

Venus will pass from Sagittarius into Capricornus by the 15th, and Mars will be apparently in Sagittarius during the month.

The Earth's nearest approach to the Sun will be on 2nd January, when fortunately 91,330,000 miles will separate them.

On the 6th, at 3 p.m., the Moon will be passing from west to east of Neptune, which will be 3 degrees north of it. Three days later the Moon will pass Jupiter at a distance of 6 degrees.

Venus, near the border of Aquarius, will become stationary on the 13th, then slowly retreat from Right Ascension 21.39 to 21 hours 16 minutes on the 31st.

Antares will be occulted by the Moon on the 12th when below the horizon in Queensland.

When the Sun sets on the 15th Mercury and the New Moon will be so close to it as to be entirely lost in the Sun's great light.

It will be interesting to notice that on the evening of the 15th Mars will set at 8.9 p.m., Saturn at 8.13, and Venus at 8.24, and that Mars and Saturn will draw nearer to one another till the 18th, after which they will be getting wider apart.

At 9 a.m. on the 17th Mercury will be in conjunction with the Moon when in the north-east by east. An hour later Saturn will be in conjunction with the Moon, also in broad daylight. Ten hours later, at 8 p.m., Venus too will be in conjunction with the Moon.

On the 20th Mercury will be on the farthest side of its orbit, almost in a line with the Sun, but a degree and a-half on the south side of it.

7 Feb.	☽	Last Quarter	7 22 p.m.
14 ,,	●	New Moon	10 43 a.m.
21 ,,	☾	First Quarter	4 5 p.m.

Perigee, 12th February, at 9.18 p.m.
Apogee, 24th February, at 8.12 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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QUEENSLAND AGRICULTURAL JOURNAL

VOL. XLI. 1 FEBRUARY, 1934. PART 2.

Event and Comment.

Tropical Agricultural Research.

TROPICAL agricultural development in Queensland has become a matter of major importance. Writing on this subject recently, the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, said:—

When the solvency of any particular territory depends on a single form of production that locality is a hostage to fortune. This fact has been forcibly if painfully demonstrated during the past few years in our exclusively pastoral areas of the West.

In the North sugar is queen. No other primary industry of a major nature exists, and neither individuals nor institutions can feel secure or confident under this state of affairs. Sugar, of course, could never be dethroned under normal conditions, but we have reached our limits of production in this direction, and must cast about for new avenues of activity.

Necessarily these do not lie in an expansion of secondary industries, but in a closer realisation of our agricultural possibilities. An almost identical position confronted the peoples of the British West Indies, and a tropical research and experiment station was established in an endeavour to provide an answer to the often repeated question, "What agricultural possibilities do the islands offer?" The result has been a surprisingly successful agricultural development, and the institute has obtained world-wide recognition. What Trinidad has done for the Indies the proposed Tropical Research Station at South Johnstone

may accomplish for tropical Queensland, and not only for the northern portion of our State, but for a quarter of the continent, and for the mandated islands under our control.

The proposed location is ideal, for both soil and climate are characteristic of the North. Results, however, will not be obtained in a day or a year. Agricultural research is tedious but inspiring for that small band of men, and latterly of women, who have embarked upon it. The scope of the Bureau will embrace agricultural research, tropical agricultural education and supplementary dietary investigation.

The first of these—agricultural research, and at this institution the most important—will be divided into two groups: the "short-term phase" and the "long-term phase." The first of these will be directed towards the greater application of scientific principles of agriculture, in relation to existing Australian tropical agricultural industries, other than the sugar industry.

Included in this programme will be soil surveys, varietal, fertilizer and cultural trials, improvement of varieties by breeding and selection, and plant protective investigation in entomology or pathology. The crops receiving attention under this section will be maize, tobacco, pastures, and fruit. In the case of fruit, particular attention will be given to the development of supplies of known producing strains, together with suitable standardised stocks, in order to produce a uniform result.

The "long-term phase"—the eminent justification for the establishment of the station—will take the form of fundamental investigation of the possibilities, both agricultural and economic, of at present non-existent tropical agricultural industries. This work will include the introduction, acclimatisation, and selection of strains of plants most suited to tropical Australian conditions, the determination of the most suitable regions in tropical Queensland for the growth of such plants, the development of the most suitable agricultural practices, methods of harvesting and marketing of crops.

The successful development of such industries will naturally be dependent upon economic rather than climatic factors. Particular attention, therefore, will be paid to the development of cultural and harvesting methods, which are less dependent upon unskilled labour than is the case in the other tropical countries of the world. Tropical products which are imported into Australia and which suggest themselves as being desirable of investigation are tea, coffee, cocoa, hemp, spices, kapok, tapioca, edible nuts, vanilla, rubber, and fruits which at present are not grown commercially, such as the mangosteen and the avocado pear.

It is not suggested that the crops enumerated above will all succeed. Were success certain the necessity for a bureau would disappear, but such work constitutes a prerequisite to the successful and permanent agricultural colonisation of the most vulnerable part of our continent.

It must be remembered that educationally no facilities exist anywhere in Australia to provide a training in tropical agriculture for our college and university graduates. South Johnstone will fill this need.

On the establishment of the bureau arrangements will be made to offer facilities to approved graduates to undertake a post-graduate course in tropical agriculture. By this arrangement the research facilities of the University will be definitely linked with a new and important arm of agricultural development.

Agriculture in the tropics is different in many respects from agriculture in the temperate zones, and, in addition to the South Johnstone station, there is, therefore, in contemplation the conversion of Kairi State Farm on the Atherton Tableland into an institution for the imparting of agricultural knowledge associated with certain investigation work. What we contemplate is not another agricultural college but a farm school which will conform to the general requirements of practical agriculture.

We must avoid at all costs the raising of a generation of agricultural labourers. A sound understanding of the principles of agriculture or the absence of this understanding makes all the difference between the agriculturist and the agricultural labourer. Kairi will provide the possibility for this distinction. The Atherton Tableland, with its congenial climate, wonderful soils, and natural agricultural utility, is an ideal setting for the school. In addition, problems of first magnitude can be investigated at first hand on the Tableland in conjunction with the bureau at South Johnstone. Of these the most important is the production of high protein grasses and crops, assets in which the Tableland is conspicuously deficient at the present time.

The two organisations, taken in conjunction, will provide for the well-balanced application of all that is best in agriculture, and should make a valuable contribution to the future development of what is probably the most fertile area in Australia—an area which is merely waiting for a complete understanding of its many difficulties and variations to yield wealth and happiness to the people of the North and to Queensland generally.

Financing the Wheat Pool.

In reply to a question as to how the wheatgrowers would fare concerning a first advance, which it had been claimed was held up owing to his (the Minister's) decision to extend to 22nd January the date for receipt of a petition for a ballot on the question of the extension or otherwise of the Wheat Pool, the Minister for Agriculture and Stock (Mr. F. W. Bulcock) stated that he understood that the Wheat Board, prior to the extension of the date for the receipt of the petition, had made arrangements with the Commonwealth Bank for suitable financial accommodation.

"I am not aware," said the Minister, "of the nature of that accommodation, but in view of the statement made on behalf of the Board that satisfactory financial arrangements had been made prior to the 8th instant, I confidently anticipate that the Board will now be in a position to expedite the payment of the first advance."

Ticks Infesting Domesticated Animals in Queensland.

By F. H. S. ROBERTS, M.Sc., Entomologist, Animal Health Station, Yeerongpilly.

THE intention in this article has been not only to give an account of the several species of ticks infesting domestic animals in Queensland, but also to place in the hands of the interested stockowner information which it is hoped will enable him to recognise the more important species.

Life History of Ticks.

In the life history of Ixodid ticks four distinct stages are recognised—namely, the egg, the larva, the nymph, and the adult. When engorged the female tick drops from the host animal to the ground, crawls to some sheltered spot, and lays her eggs. After a period, dependent mainly upon temperature and humidity, these eggs hatch to give rise to the tiny larvæ (Plate 26, figs. 6 and 7). The larvæ or seed ticks, as they are frequently called, have only three pairs of legs in contrast to the adult tick's four pairs. After a time sufficient for the body parts to harden the larva crawls up to the top of the grass or some other convenient point, and is eventually brushed off by its host, to which it adheres. A suitable spot on the host animal is found, and the tiny larva inserts its mouth parts and begins to suck blood. When fully fed it may drop off the host to the ground or remain attached to its host, in either case finally casting its skin to appear as a nymph. The nymph has four pairs of legs like the adult, but is not sexually mature and has no genital orifice. If the moult has occurred on the ground, the nymph repeats the activities of the larva, and soon becomes attached to another host. After attachment the nymph in its turn engorges and may detach itself and drop off or remain on the host to undergo the second moult. And now the sexually mature adult appears. The host is eventually reached in the manner of the larva and nymph, and the adult tick begins to feed. The sexes mate and the female engorges rapidly, eventually becoming enormously swollen with blood. She then drops off, lays her eggs, shrivels up and dies.

DESCRIPTION OF PLATE 26.

Fig. 1. *Longirostrata.*—A tick with long mouth parts. (*a*) Mandibles; (*b*) Mandibular sheath; (*c*) Palp; (*d*) Eye; (*e*) Scutum or dorsal shield.

Fig. 2. Ventral view of the Capitulum of a tick showing the mouth parts. (*a*) Mandibles; (*b*) Hypostome; (*c*) Palp.

Fig. 3. *Brevirorstrata.*—A tick with short mouth parts. In this tick—a male—the scutum covers the whole of the back.

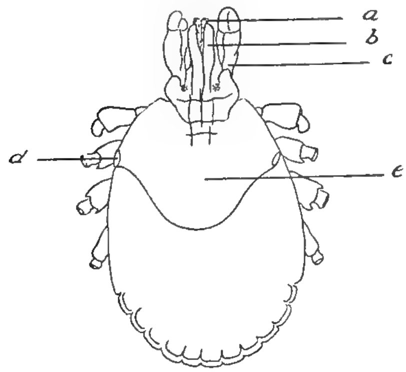
Fig. 4. *Brevirostrata.*—A female tick with the scutum extending over only a small area near the head.

Fig. 5. *Prostriata.*—The anal grove contours, the anus in front. (*a*) Anus; (*b*) Anal groove.

Fig. 5A. *Metastriata.*—The anal grove contours, the anus behind. (*a*) Anus; (*b*) Anal groove.

Fig. 6.—Larva of the cattle tick, *Boophilus microplus* Canes.

Fig. 7. Larva of the scrub tick, *Ixodes holocyclus* Neum.



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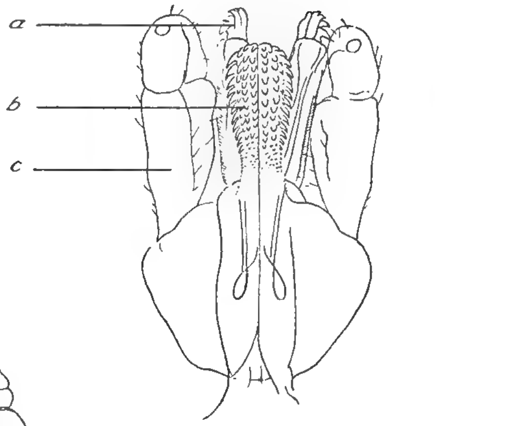

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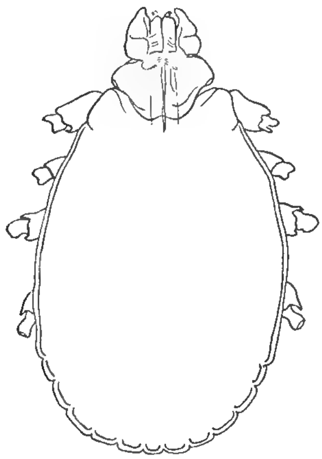

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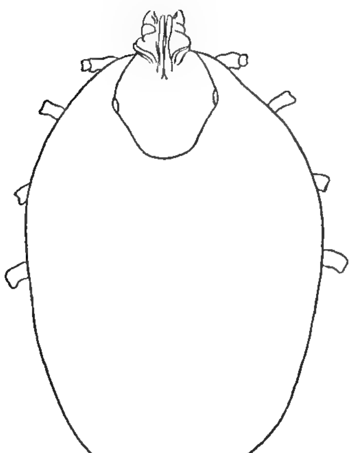

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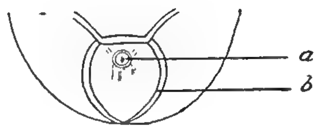

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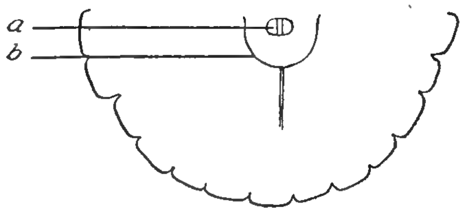

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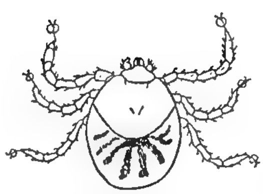

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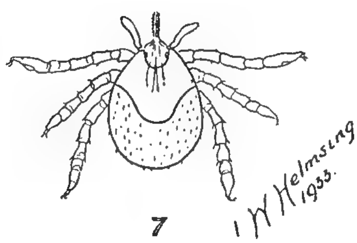

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Plate 26.

A tick which is able to complete its life history without at any time leaving its host is called a one-host tick. Should it drop to the ground to undergo the larval and nymphal moults, it becomes a three-host tick, whilst only one moult occurring on the ground and the others on the host makes it a two-host tick.

The life history of the poultry tick, *Argas persicus,* is, however, different to that of Ixodid ticks. The adult female may lay several batches of eggs, which hatch into typical six-legged larvæ. The larvæ attach themselves to the birds and remain on them till fully engorged. There are then two nymphal stages before the adult phase is reached and, like the adult, these two nymphal forms feed only at night, remaining hidden in cracks and crevices during the day.

Structure of Ticks.

Generally speaking, ticks have an undivided oval-shaped body protected externally by a leathery cuticle. At the anterior end is a structure known as the capitulum (Plate 26, figs. 1 and 2) which carries the mouth parts, whilst the body proper bears the legs, of which there are four pairs in the adult stage. The mouth parts consist of the beak and the palpi. The beak includes the hypostome, mandibular sheath, and mandibles (Plate 26, figs. 1 and 2). The hypostome can be seen ventrally, is club-like in shape, and provided with rows of recurved teeth (Plate 26, fig. 2). The mandibles are used when the tick is piercing the skin, and the rows of recurved teeth on the hypostome explain why a tick when pulled out so often leaves its "head" behind. On the dorsal surface can be seen in most species a hard shield—the scutum—which in the male covers practically the whole of the back and in the female a smaller area close to the capitulum (Plate 26, figs. 1e, 3, and 4). Eyes may be present or absent, and if present may be detected close to the lateral angle of the scutum (Plate 26, fig. 1d.). On the ventral surface will be found the genital and anal openings. The former is usually situated far forward between the coxæ of the legs, whilst the latter is nearer the posterior margin and generally partly enclosed in front or behind by a grove—the anal grove—a character of great importance in determining the various species (Plate 26, figs. 5 and 5a).

Classification of Ticks.

The super-family to which the ticks belong is known as the *Ixodoidea,* which is divided into the families *Argasidæ* and *Ixodidæ.* In the *Argasidæ* there is no dorsal shield or scutum, the back being provided with a tough, leathery integument only. Moreover, the mouth parts and palps are invisible when viewed from above, being placed ventrally (Plate 26, figs. 7 and 8). In the *Ixodidæ* these parts are terminal and a scutum is always present (Plate 27, figs. 1-6). The *Ixodidæ* are then divided into the *Prostriata,* in which the anal grove contours the anus in front (Plate 26, fig. 5) and the *Metastriata* where it contours the anus behind (Plate 26, fig. 5a). Finally, the *Metstriata* comprise the short mouth part ticks, the *Brevirostrata* (Plate 26, figs. 3 and 4), and the long mouth part ticks, the *Longirostrata* (Plate 26, fig. 1).

The Poultry Tick (*Argas persicus* Oken 1818).

(Plate 27, figs. 7 and 8.)

This is a cosmopolitan species, and is to be found in every part of this State. It not only attacks fowls, but also ducks and pigeons. It appears to thrive in the drier parts of Queensland, and is regarded as a serious pest of poultry wherever it occurs. This species, except in the larval stage, feeds only at night, and when present in numbers may cause serious mortalities, especially among young birds. Its survival in fowl-houses which have remained empty for considerable periods of time is astounding. One such record made in one of the hottest and driest parts of the State is that of a fowl-house which remained infested for two and a-half years, during the whole of which time it was not inhabited by fowls.

The prevalence of *spirochætosis* among fowls in Queensland is not known to any degree of accuracy, but frequently cases have been encountered where mortalities have definitely been caused by this disease.

The poultry tick is a flat, oval, leathery tick, without a dorsal shield or eyes. The mouth parts are entirely invisible when viewed from the dorsal surface, which is marked with numerous symmetrically arranged discs more or less disposed in radial lines.

The Scrub Tick (*Ixodes holocyclus* Neumann 1899).

(Plate 27, figs. 3 and 4.)

This tick also known as the "bottle" tick appears to be confined to the coastal scrubs, with a distribution as far west as Toowoomba, and extending northwards to the Atherton Tableland and Norman River. Its native hosts comprise the wallaby, kangaroo, opossum, bandicoot, native bear, pouched mouse, &c., among which it does not appear to cause any great inconvenience. On man and the domesticated animals, however, the presence of this tick may be responsible for a serious condition, which may be followed by paralysis and death. Such fatalities are especially noticeable among dogs and sheep, but deaths from scrub tick attack is also known among cats, foals, calves, pigs, fowls, ducks, and even man. In several North Coast areas the successful raising of sheep is prevented mainly through the mortalities from this tick, especially during the spring months.

This species is a three-host tick—that is, the larva and nymph drop from the host in order to undergo the moulting process, gaining a new host when the new stage appears. The male is an oval tick, rounded behind, and somewhat reddish-yellow in colour. The mouth parts are terminal, long and prominent. The partly-fed female is greyish, but when fully engorged this sex becomes very large and dark red. If the anal grove is examined, it will be found that in both sexes it contours, the anus in front converging behind, so that it meets at the edge of the body in the female, but remains narrowly open in the male.

The Opossum Tick (*Ixodes tasmani* Neumann 1899).

There is a single record of this tick occurring on a horse. Other hosts from which the opossum tick have been collected include the opossum, native bear, native cat, and man. This species has been recorded from Gayndah, Eidsvold, Bundaberg, Brisbane, Logan, Boyne Valley, Jondaryan, Harrisville, and Roma.

The opossum tick is very similar to the scrub tick, but may be distinguished by the anal grove, which is this species is not convergent behind but remains almost parallel.

The Brown Dog Tick (*Rhipicephalus sanguineus* Latreille 1804).

(Plate 28, figs. 3 and 4.)

Like the poultry tick, the brown dog tick is a cosmopolitan species, and may be found anywhere in Queensland. Some of the heaviest infestations have been observed in the driest and most remote portions of the State. Infestation of dwellings by this tick are not uncommon, due to carelessness in allowing infested dogs indoors. The fact that this is a three-host tick and that the dog is a thoroughly domesticated animal probably explains its wide distribution. In other parts of the world the brown dog tick is a vector of canine pyroplasmosis, but so far as can be ascertained this disease is not present among dogs in Australia.

The brown dog tick bears a superficial resemblance to the cattle tick, but may be readily recognised by its brown legs, the presence of an anal grove, and by the conspicuous bifid first coxæ. Other hosts on which this tick may be found are sheep, cattle, horse, cat, and man.

The Cattle Tick (*Boophilus microplus* Canestrini).

(Plate 27, figs. 1 and 2.)

This species, previously known as *B. australis,* is without doubt the most important of all ticks found in Queensland. It is not a native species, and occurs also in Asia, South America, and South Africa. Its importance lies in the fact that not only has it found climatic conditions so suitable for its development that it has become a serious cattle pest in itself, but it is also the vector of *Piroplasma bigeminum,* which is responsible for cattle-tick fever and probably of two or three other organisms which are possibly concerned with other serious cattle diseases.

This cattle tick is a one-host tick. It may be readily distinguished from other ticks found on cattle in Queensland by the following features:—

(1) The mouth parts are small and the palps do not project laterally at their base as in some species of *Hæmaphysalis.*

(2) Eyes are present. In the species of *Hæmaphysalis,* with which *B. microplus* is most likely to be confused, eyes are absent.

DESCRIPTION OF PLATE 27.

CATTLE TICK—*Boophilus microplus* Canes.

Fig. 1.—Male × 5. Fig. 2.—Female × 5.

SCRUB TICK—*Ixodes holocyclus* Neum.

Fig. 3.—Male × 5. Fig. 4.—Female × 5.

WALLABY TICK—*Hæmaphysalis bancrofti* (Warburton and Nuttall).

Fig. 5.—Male × 5. Fig. 6.—Female × 5.

FOWL TICK—*Argas persicus* Oken.

Fig. 7.—Male × 7. Fig. 8.—Female × 7.

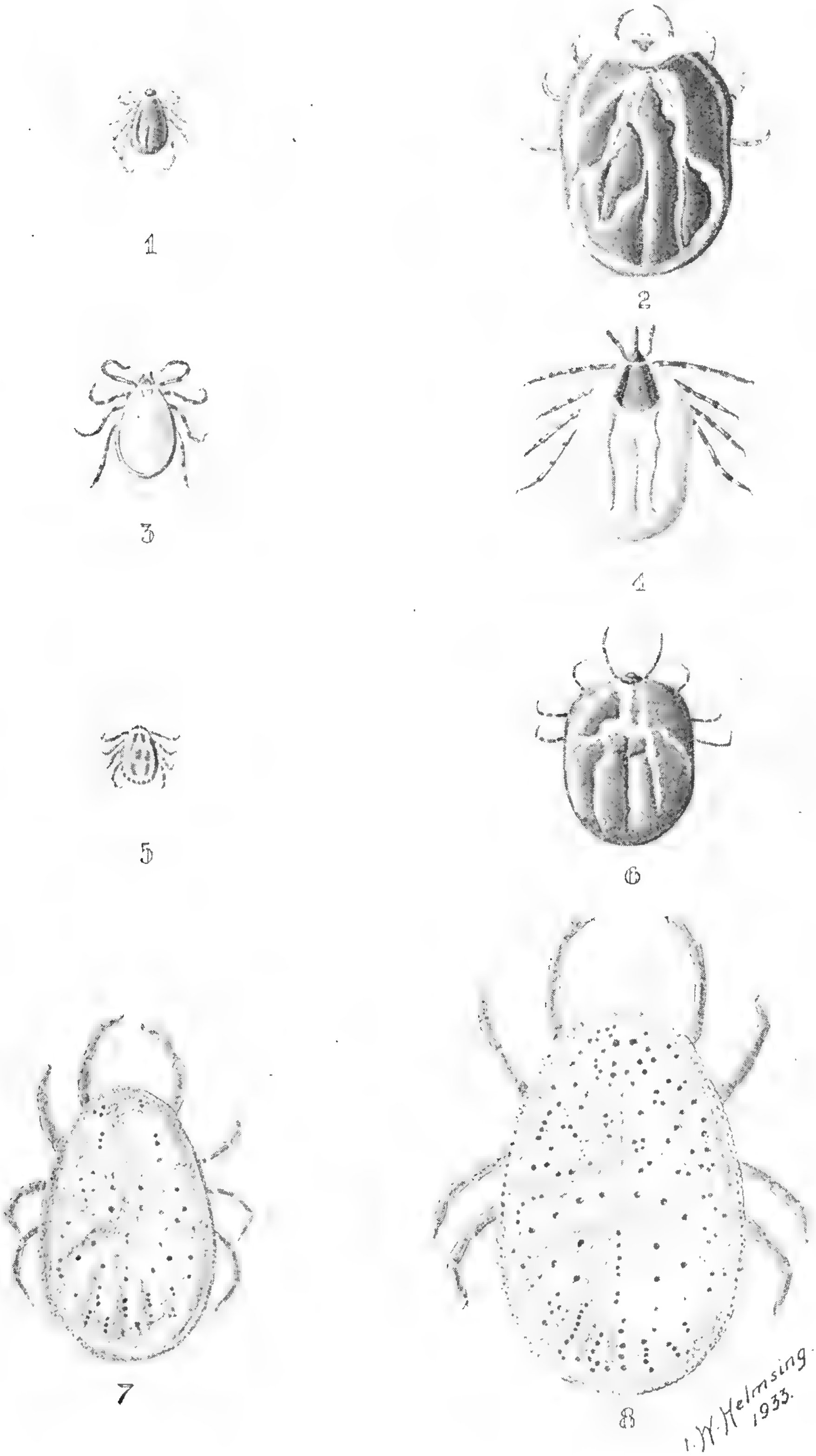

Plate 27.

(3) There is no apparent anal grove.

(4) The legs are short and very pale. *B. microplus* is the only species of tick with short mouth parts and with pale almost whitish legs.

This species has also been recorded from horses, sheep, and dogs.

The Wallaby Tick (*Hæmaphysalis bancrofti* **Warburton and Nuttall 1915**).

(Plate 27, figs. 5 and 6.)

The species of the genus *Hæmaphysalis* have a distinct anal grove, usually laterally projecting palps and no eyes. The wallaby tick is frequently found on cattle and is recorded from Townsville, Rockhampton, Murgon, Maleny, Brisbane, Kingaroy, Helidon, Toowoomba, and Maryvale. It appears to be confined to the southern portion of the State, mainly the south-east. It has also been collected from the kangaroo, rat-kangaroo, opossum, and man. In this species the legs are brown, the mouth parts short, and the palps project very strongly laterally. The life history is unknown, but like other species of the genus it is probably a three-host tick.

The New Zealand Cattle Tick (*Hæmaphysalis bispinosa* **Neumann 1897**).

(Plate 28, figs. 1 and 2.)

This introduced species is found in India, Burma, Borneo, Malay States, Japan, East Africa, and New Zealand, as well as in Australia. It is said to be very commonly found on cattle on the north coast of New South Wales, but in Queensland, so far as the records show, it is by no means common. Specimens have been taken from cattle at Tullebudgera, Toowoomba, Bell, Jondaryan, Killarney, Helidon, Murgon, and from horses at Taroom and Gympie. This species may readily be mistaken for the common cattle tick, but its brown legs and the presence of an anal grove and a prominent dorsal spine on the third segment of the palps readily distinguish it. This species is a three-host tick.

The Slender Opossum Tick (*Hæmaphysalis humerosa* **Warburton and Nuttall 1929**).

Among the material examined there are specimens of this tick from cattle at Rockhampton and a horse at Helidon. It has also been collected from bandicoots and opossums at Maryborough, Harrisville, and Springsure. The dorsal shield or scutum in this species is much longer than

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DESCRIPTION OF PLATE 28.

Hæmaphysalis bispinosa Neum.

Fig. 1.—Male × 5. Fig. 2.—Female × 5.

Rhipicephalus sanguineus Latr.

Fig. 3.—Male × 5. Fig. 4.—Female × 5.

Hyalomma ægyptium Linné.

Fig. 5.—Female × 5.

Amblyomma triguttatum Koch.

Fig. 6.—Male × 5. Fig. 7.—Female × 5.

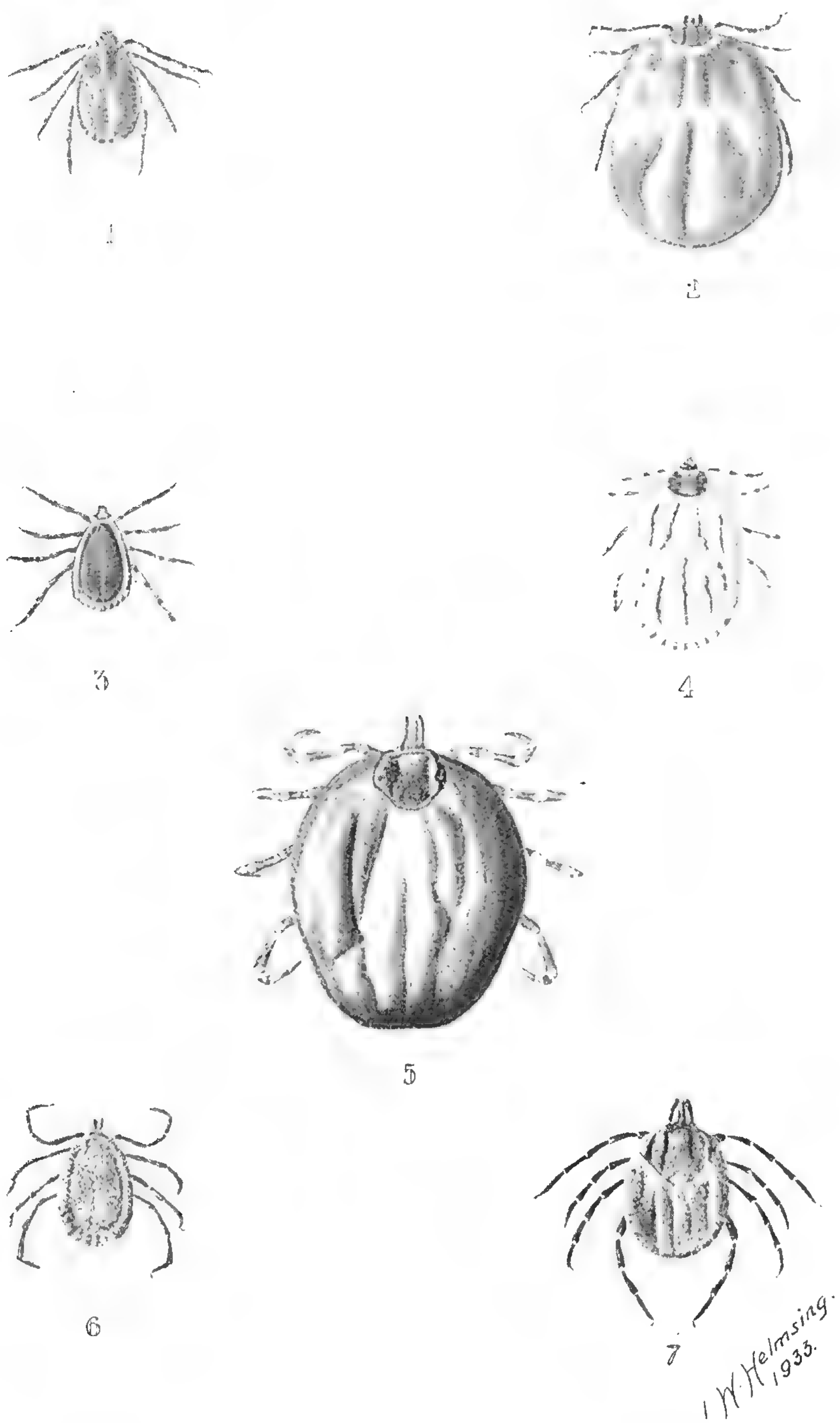


Plate 28.

broad, giving the male a long, slender appearance, a peculiarity which is not quite so marked in the female.

The African Dog Tick (*Hæmaphysalis leachi* **(Audouin 1827) (Neumann 1897)).**

This species has been recorded from Australia from the wallaby and from a horse. The writer has never encountered this tick, but is informed by Dr. J. Legg, of the Animal Health Station, Townsville, that he has taken it there on sheep. This tick also occurs in Africa, India, Sumatra, Borneo, Malay States, and New Zealand. In Africa it transmits the organism of malignant jaundice or pyroplasmosis of dogs.

The Bont Leg Tick (*Hyalomma ægyptium* **Linne 1758).**

(Plate 28, fig. 5.)

The material examined included two females of this species from a bullock and horse respectively at Warwick. The bite of this tick is particularly severe, and has a notorious tendency to cause abscesses and sloughing of the skin. It is readily recognised by its branded legs and dull brown body. This and the remaining species dealt with hereafter belong to the *Longirostrata*—that is, the mouth parts are conspicuous and long. The bont leg tick is very common in India and Africa, and has also been recorded from parts of Europe. This is a two-host tick.

The Kangaroo Tick (*Amblyomma triguttatum* **Koch 1844).**

(Plate 28, figs. 6 and 7.)

As this species is normally found on kangaroos, its distribution in Queensland is fairly extensive. Localities from which it has been recorded extend from Burketown and the Norman River in the north to the Logan River in the south, and as far west as Camooweal, Longreach, and Augathella. Domesticated animals from which it has been collected include cattle, horse, and dog, while the native hosts comprise the wallaby, platypus, and dingo, besides the kangaroo.

This tick may be readily recognised by the conspicuous coloration of the dorsal shield. In the female this shield is reddish-brown with a single whitish spot in the posterior angle. In the male there are a pair of irregular pale areas in the lateral fields and a pair of smaller spots posteriorly. Variations in this colour scheme are frequent, the most usual being to find on the female scutum an irregular pale area laterally in addition to the posterior spot. The male scutum may show a broad median band with extensive lateral markings. The life history of the kangaroo tick is unknown.

The Snake Tick (*Amblyomma moreliæ* **L. Koch 1867).**

The native hosts of this species include several species of snakes and goannas, the wallaby, and kangaroo. The domesticated animals from which this tick has been collected comprise cattle at Hughenden and a horse at Rosewood. Other locality records are Ingham, Bowenville, Toowoomba, and Esk. The male tick has two pairs of irregular pale areas in the scapular fields of the dorsal shield and two or three pairs of small spots behind the eyes and extending along the conspicuous marginal grove posteriorly. The female has a reddish-brown dorsal shield with a marked but irregular pale area near each eye.

The Bont Tick (*Amblyomma hebræum* Koch).

There is a female of this species in the departmental collection. The locality is not legible on the label and the host is given as a horse. The presence of this tick in Queensland is therefore not at all certain.

The Goanna Tick (*Aponomma trimaculatum* Lucas 1878).

In this genus the eyes are absent, and, as in *Amblyomma,* the mouth parts are conspicuous and long. The males are usually small, broad, and almost circular in outline, the females being larger and somewhat similar in appearance. This species is a small brilliantly coloured tick occurring in North Queensland and New Guinea. The usual hosts are snakes and goannas, but among the material is a specimen from a horse at Townsville.

Instructions for Collecting Ticks.

The species of ticks occurring in Queensland are by no means adequately known, and great assistance could be given by interested persons by forwarding any specimens they may come across. Ticks may occur on any of the domestimated animals, the many species of marsupials, snakes, goannas, lizards, tortoises, and birds. In the case of birds, ticks are frequently found in the nests. The specimen should be detached by a slow, gentle pull, so that the mouth parts are not injured, and forwarded in a match box, packed round with paper to prevent the specimens moving about, or in spirit, to the Animal Health Station, Yeerongpilly, Brisbane.

ACKNOWLEDGMENT.

The writer desires to acknowledge his appreciation of the illustrations by Mr. I. W. Helmsing, Illustrator, Entomological Branch, through the courtesy of the Chief Entomologist, Mr. Robert Veitch.

Banana Thrips Control.

By ROBERT VEITCH, B.Sc. Agr., B.Sc. For., F.E.S., Chief Entomologist.

THE very small and insignificant insect known as the banana thrips (*Scirtothrips signipennis* Bagnall) occupies second place in the list of Queensland insect enemies of the banana, for it has to yield pride of place to the banana weevil borer (*Cosmopolites sordida* Chevr.) which is present in practically every large banana-growing district in Queensland.

The sum total of losses due to the borer is undoubtedly greater than that resulting from the activities of the thrips, but two significant differences in the incidence of infestation merit attention. Firstly, losses in the quantity and quality of fruit as a result of borer attack are greater than is generally realised, mainly because borer infestation is not very obvious; on the other hand, the rust produced in a severe thrips attack cannot possibly escape notice. Secondly, where thrips does occur in epidemic proportions with severe associated rust, virtually the whole cut of fruit on a plantation may be lost. Hence, although a State-wide estimate of losses shows weevil borer to be responsible for the greater damage, it actually happens that in certain restricted areas thrips is a much more destructive insect in so far as the reduction of marketed fruit is concerned.

Distribution in the State.

The banana thrips is well distributed throughout Queensland and occurs in small numbers in quite a number of districts in which banana-growers have sustained no losses of fruit, and, indeed, in some cases the growers are not even aware of the presence of the insect, which can, of course, be readily overlooked unless carefully searched for. There are, however, two districts in which it has been abnormally abundant and in which it has been responsible for devastating losses; these are Gympie and the far north of Queensland. A very serious outbreak occurred in the Gympie district in 1924, but for a number of years thereafter losses were comparatively slight. However, in 1931 the position once more became acute and further serious losses occurred. The history of the Gympie outbreaks thus indicates a very pronounced seasonal fluctuation in losses, and shows that although losses may be serious one year it does not necessarily follow that they will continue so without interruption. The second district in which losses have been very heavy is the coastal banana-producing area north of Cardwell, in North Queensland.

Nature of Injury.

Both the larval and adult thrips feed on the skin of the fruit, and the term "rust" has been appropriately used to denote the type of injury characteristic of outbreaks of this pest. Rust in bananas, however, is in no way analogous to rust in wheat, for the latter is due to the presence of a fungus, whereas the former is the reaction of the skin of the fruit to the feeding of an insect. The attacked skin presents a typical reddish-brown appearance and has a somewhat rough surface. The discoloration and roughening of the skin may be confined to the point of contact of the individual fruits at the stalk end of the fruit. It can, however, extend over practically the whole of the surface of the fruit, which may subsequently become badly cracked.

A small amount of rust on a banana does not affect the palatability of the fruit, although it certainly renders its appearance less attractive. In cases where the skin is badly rusted, however, the quality of the fruit is definitely impaired, and large quantities of fruit may be rendered quite unmarketable.

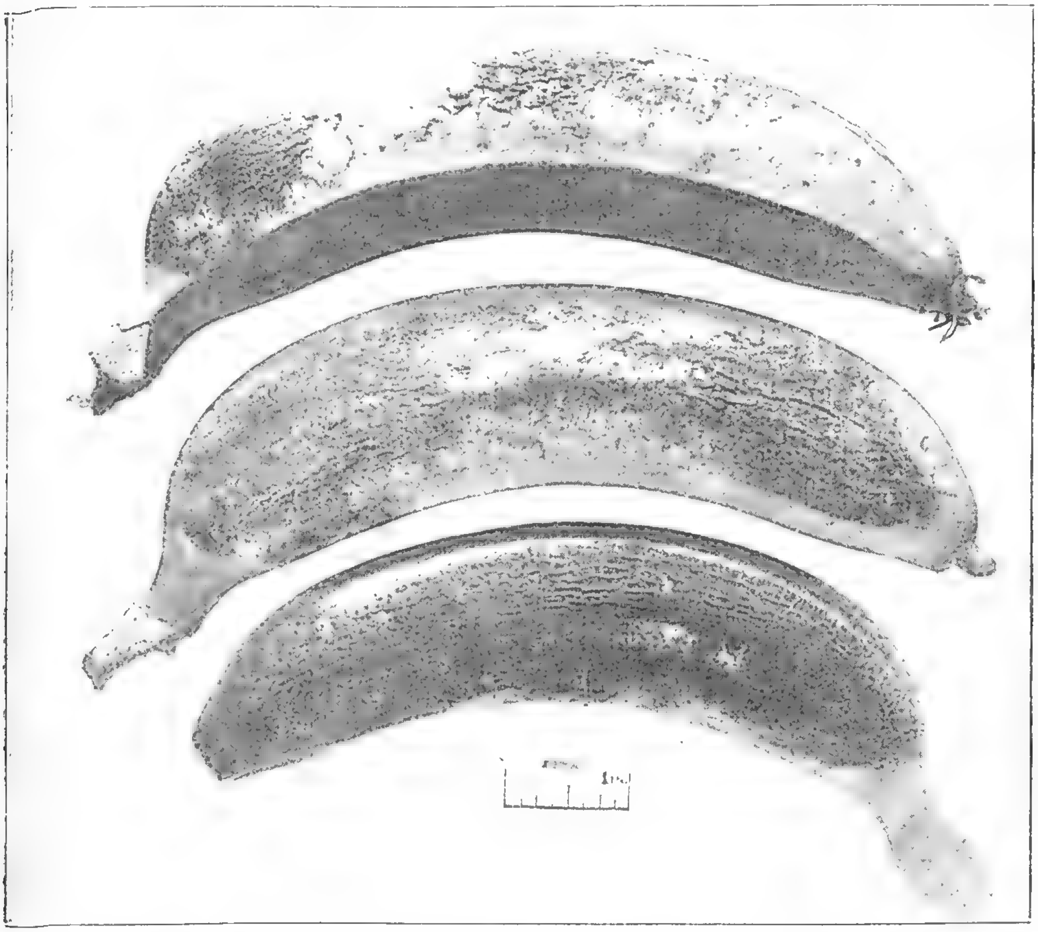


PLATE 29.—BANANA FRUIT SHOWING "RUST" DUE TO THRIPS ATTACK.

Life History and Life Cycle Stages.

The very small eggs of the thrips are laid in the plant tissue, the eggs being deposited therein in punctures made by the adult insect. They are commonly laid on the fruit, particularly at the points of contact between the individual fruits and also under the leaf sheaths. Colonies are most numerous in these two parts of the plant.

The eggs hatch out in about a fortnight, and the white-coloured larvæ emerging therefrom become full grown in a week, being then approximately one twenty-fifth of an inch in length. The full-grown larvæ generally pupate in the soil, but pupation may occur on the plant, and after a pupal period of about a week the delicate yellow-coloured adults emerge. They possess two pairs of narrow-fringed wings, at the base of each of which there is a distinct dark area.

There is not infrequently some uncertainty as to the identity of small insects associated with bananas, and species of insects known as

springtails, most of which are merely scavengers, have been mistaken by growers for the dreaded banana thrips. Should a grower be in any doubt on that point, he should forward specimens to Mr. N. E. H. Caldwell, Assistant to Entomologist, Department of Agriculture and Stock, Nambour, who will be only too pleased to definitely identify the specimens.

Thrips Control Experiments.

Having indicated the nature of the damage and of the insect responsible for it, an outline of what may be done to control this pest can now be given, and from the grower's point of view that is, of course, a vitally important matter.

A very considerable amount of attention has been devoted to the problem of control, and extensive field experiments have been carried out by departmental officers. Indeed, the results of certain large scale experiments in North Queensland have just been published in the "Queensland Agricultural Journal," and it is largely on the results of these experiments that the present control recommendations are based. These recommendations will be found to be very useful, but an effort is being made to still further improve on them. With this object in view the Minister for Agriculture and Stock appointed an officer in June of last year to work full time on the thrips problem, and that officer recently initiated a number of field experiments. The investigator in question, Mr. N. E. H. Caldwell, is a State departmental officer, but his appointment was made possible by a grant from the Commonwealth Banana Committee.

Control Measures.

Where infestation occurs and the thrips is present in large numbers, growers should give serious consideration to dusting the bunches at regular intervals during the warmer months of the year. In the present state of knowledge, the most effective dust to use is a nicotine dust, preferably one in which the nicotine is present as free nicotine, although dusts in which the nicotine is present as nicotine sulphate can also be used with beneficial results.

The dusting should be done at weekly intervals. Ideally the dust could be applied with a rotary duster fitted with a special flexible outlet pipe; dusting can, however, be accomplished by the use of a relatively inexpensive hand dust gun. The latter type is actually in use for the present series of experiments. The exact time of the year at which dusting should commence on any particular plantation must, of course, be left to the discretion of the individual grower. Growers are reminded that caution must be exercised in the application of dusts for, if unnecessarily large quantities are used, an unsightly residual deposit may eventually accumulate on the fruit.

A grower situated in a district in which thrips is known to occur would be well advised to inspect the bunches at regular intervals, and if thrips shows signs of becoming abundant, then, as indicated, dusting the bunches with nicotine dusts is the most promising control measure to adopt.

Obviously, where areas are free from thrips infestation, every effort should be made to keep them so, and it would be manifestly unwise to introduce suckers to such a clean area from one already known to be infested. In this connection it has sometimes been suggested that suckers might be freed from thrips infestation by dipping in nicotine sulphate.

Such dipping cannot, however, be relied upon to completely free the suckers from infestation, although it will undoubtedly reduce the number of thrips associated with the plants.

Each year the Banana Industry Protection Board drafts a planting policy, in which the securing of suckers is discussed. Growers should therefore make themselves acquainted with the current planting policy, particulars of which can be obtained from the local agent of the Board.

Finally, in combating the thrips menace, growers at present will have to rely mainly on dusting the bunches with nicotine dusts in areas where infestation is severe. Where infestation does not occur, every precaution must be taken to maintain these areas free from thrips.

QUEENSLAND SHOW DATES, 1934.

Stanthorpe: 7th and 9th February.
Killarney: 16th and 17th February.
Allora: 7th and 8th March.
Clifton: 14th and 15th March.
Tara: 21st March.
Milmerran: 20th March.
Goombungee: 28th March.
Pittsworth: 4th and 5th April.
Warwick: 10th and 12th April.
Toowoomba: 16th and 19th April.
Rosewood Camp Draft: 7th April.
Goondiwindi: 27th and 28th April.
Oakey: 28th April.
Taroom Camp Draft: 30th April.
Taroom: 1st and 2nd May (Camp Draft, 5th May).
Dalby: 2nd and 3rd May.
Beaudesert: 2nd and 3rd May.
Charleville: 8th and 10th May.
Nanango: 3rd and 4th May.
Blackall: 7th and 9th May.
Chinchilla: 8th and 9th May.
Crow's Nest: 9th and 10th May.
Boonah: 9th and 10th May.
Monto: 9th and 10th May.
Kingaroy: 10th and 11th May.
Ipswich: 15th to 18th May.
Miles: 16th May.
Kilkivan: 16th and 17th May.
Mitchell: 16th and 17th May.
Mundubbera: 16th and 17th May.
Wondai: 17th and 18th May.
Roma: 22nd to 24th May.
Gympie: 23rd and 24th May.
Biggenden: 24th and 25th May.
Murgon: 24th to 26th May.
Toogoolawah: 25th and 26th May.
Kalbar: 26th May.
Goomeri: 29th and 30th May.
Wallumbilla: 30th and 31st May.
Maryborough: 1st, 2nd, and 4th June.
Childers: 5th and 6th June.
Marburg: 1st and 2nd June.
Bundaberg: 7th to 9th June.
Lowood: 8th and 9th June.
Rockhampton: 19th to 23rd June.
Mackay: 26th to 28th June.
Laidley: 27th and 28th June.
Proserpine: 29th and 30th June.
Townsville Camp Draft: 30th June.
Bowen: 4th and 5th July.
Gatton: 4th and 5th July.
Kilcoy: 5th and 6th July.
Townsville: 10th to 12th July.
Woodford: 12th and 13th July.
Rosewood: 13th and 14th July.
Cleveland: 13th and 14th July.
Cairns: 17th to 19th July.
Charters Towers: 18th and 19th July.
Nambour: 18th and 19th July.
Caboolture: 20th July.
Atherton: 24th and 25th July.
Pine Rivers: 27th and 28th July.
Royal National: 6th to 11th August.
Home Hill: 31st August and 1st September.
Imbil: 7th and 8th September.
Ingham: 7th and 8th September.
Beenleigh: 20th and 21st September.
Rocklea: 22nd September.
Malanda: 26th and 27th September.
Kenilworth: 29th September.

Yeasty Rot of Pineapples and Its Control.

By H. K. LEWCOCK, M.Sc., B.Sc. Agr., Pineapple Pathologist.

FOR a number of years, considerable wastage has occurred in Queensland pineapples shipped to the markets of the Southern States through ripe rots which develop during transport and storage. These losses occur chiefly during the summer months, and to a considerable extent are due to the disease variously known as soft rot or water blister. In addition to this disease, however, there is another type of pineapple spoilage—namely, yeasty rot—which under certain conditions may cause considerable damage to fruit which has to be transported long distances. Yeasty rot also occurs under field conditions, and it is in this form only that the disease is known to most growers, who regard it as a minor trouble almost solely restricted to injured or over-ripe fruit. Likewise, fruit merchants and other trade interests have mostly failed to recognise the wastage caused by yeasty rot, as on the Southern markets there appears to be an almost universal tendency to regard all spoilage occurring in pineapples as being due to water blister. That such is not the case, however, is indicated by reports supplied through the courtesy of the Committee of Direction of Fruit Marketing from their Melbourne representative, who has estimated losses from yeasty rot in individual consignments as high as 40 per cent. Through the same organisation arrangements were made for samples of these affected fruit to be returned to Brisbane in aseptic containers for examination; the causal organism of the disease was recovered from two-thirds of the samples so received.

Description of the Disease.

External Symptoms.—A diseased condition of a pineapple affected with yeasty rot is usually not apparent until fermentation of the tissues is well advanced. Normally, the first characteristic signs of the disease are the bubbles of gas and liquid which exude from the injury or crack through which infection occurred. As fermentation progresses the fruit loses weight rapidly, due to the escape of gas and liquid, and the skin becomes leathery in texture and spongy to pressure. Finally, when all the juice has exuded, the fruit is reduced to nothing more than a shell enclosing a mass of fibro-vascular strands. In contrast to soft rot, the skin of fruit affected with yeasty rot does not become thin and brittle, but remains thick and tough. No external discoloration of the skin accompanies the actual fermentation, but in the final stages of the disease secondary rot organisms frequently induce a brown decay.

Internal Symptoms.—The flesh of fruit affected with yeasty rot has a somewhat stringy or fibrous appearance, and is ruptured and torn with large air-filled cavities extending from just below the skin almost to the core. These cavities are caused by exudation of fermenting juice. Affected tissues are canary-yellow in colour, in marked contrast to the light straw-coloured flesh of sound fruit.

The Causal Agent and Mode of Infection.

As its name implies, yeasty rot is a fermentation disease caused by various species of yeasts (*Saccharomyces*). As is the case with many other fruits, species of yeast occur normally on the surfaces of ripening pineapples. Experimental studies have shown, however, that infection

occurs only through injuries or growth cracks which rupture the skin of the fruit. The yeasts themselves are unable otherwise to penetrate this protective covering. Unlike the soft rot disease, yeasty rot infection has not been observed to take place through the cut end of the stalk.

Plate 30.—Yeasty Rot of Pineapple (Internal View).

Factors Influencing Infection.

Maturity of the Fruit.—Ripeness of the flesh, irrespective of the degree of skin coloration, is a prerequisite to infection. This may occur before the fruit is picked or after picking and while the fruit is in transit to the market.

Temperature.—Like water blister, the development of yeasty rot is favoured by high temperature conditions and inhibited by low temperatures. During the warmer months of the year, yeast infection occurring through injuries inflicted in ripe fruits by mice, birds, &c., leads to a rapid fermentation of such fruit under field conditions. In such cases, however, the disease causes no material loss. High temperature conditions obtaining during transportation of fruit to the Southern markets constitute a more serious matter. The carriage of fruit to Melbourne by rail occupies a period of four days, and should this take place during hot, sultry weather, the normally unfavourable temperature conditions of the confined van space are accentuated by retarded ventilation and the heat given off by the fruit during respiration. Under such circumstances, yeasty rot may cause heavy loss before the fruit arrives on the market, unless precautions have been taken during packing to minimise the possibility of infection.

Rainfall.—Although economic losses from yeasty rot occur chiefly in connection with the shipping of pineapples to the Southern markets during the summer months, spoilage occurs in such an irregular manner that its development is obviously determined by some inciting influence other than high temperature. It has been found that incidence of rainfall during the growth of the fruit is the chief factor which indirectly limits the development of yeasty rot in pineapples during transport. A protracted period of dry weather during the summer growing season results in the fruit becoming "skin bound" as they approach maturity. Should heavy rains occur at or about the time the fruit is ripening, sudden swelling of the tissues takes place, resulting in the development of minute cracks and fissures in the tightly bound skin. It is through growth cracks arising in this manner that the yeasty rot organism gains entry to sound, marketable fruit. Weather conditions such as those outlined above obtained fairly generally during the summers of both 1932 and 1933 and, consequently, heavy losses from yeasty rot occurred in many interstate shipments of pineapples made in these years. In seasons of normal rainfall, however, the disease does not appear to be of very great importance.

Control Measures.

The percentage of marketable fruits affected under field conditions is seldom high enough to cause appreciable wastage and, consequently, the need for controlling losses from this form of the disease rarely arises. It is only during the transport of fruit to distant markets that losses from yeasty rot are of economic importance. Such losses may be rendered negligible or entirely avoided if—in addition to the careful handling customarily given to fruit intended for interstate markets—the following precautions are observed at times when the disease is likely to occur:—

(1) When packing for distant markets, discard all fruits showing abrasions or recent growth cracks, the presence of which is usually indicated by exuding juice. Ordinarily, such fruits are quite acceptable for cannery purposes if processed without delay, or they may be disposed of through any other local outlet which will permit them to pass into consumption quickly.

(2) Avoid packing fruit while still wet from rain or dew, and use only packing material which is thoroughly dry.

(3) Practice strict sanitation both in the field and in the packing shed. Damaged or diseased fruit should not be left to decay in the plantation or thrown into a heap near the packing shed, but should either be buried or removed to low-lying waste land where they are not likely to prove a source of infection.

COLD STORAGE OF TOMATOES.

How far is it practicable to hold tomatoes in cold storage, in order that temporary gluts may be relieved and better average returns ensured? The genesis of recent investigations in this connection, states the "Agricultural Gazette" of New South Wales, was the mention by Messrs. Granger Bros., of Narrandera, in a letter to the Department of Agriculture, of the fact that tomatoes if picked green would keep up to two months in their district at an average temperature of 50 deg. Fahr. (natural temperature), the fruit gradually ripening during storage. They suggested that perhaps it would keep for several months at a lower temperature in a cool store. Subsequently they forwarded four cases of Bonny Best tomatoes to the Sydney Municipal Cold Storage Works for trial.

The tomatoes were very green when stored; no special attention was given to the method of packing, the cases being merely lined with paper. The storage temperature was about 34 deg. Fahr. For the first three weeks no alteration was noticed in the colour or appearance of the tomatoes, and when cut open they appeared the same as when placed in store. At the end of four weeks a slight shrivelling of the skin, especially around the stalk, was noticed, and the colour, if anything, was not as green as before. After the sixth week the fruit broke down completely, spots of mildew appeared around the stalk and anywhere on the skin where there were any blemishes, the colour changed to a yellow-green, and the fruit took on a distinct waxy or glassy appearance.

Apparently three to four weeks would be the limit of cool storage for this variety of tomato under the conditions observed above, as from this time the fruit very quickly deteriorated, and it is very doubtful if it could be taken from store and ripened before it broke down completely.

In the report of the Food Investigation Board for 1927 (England), it is stated that tomatoes kept at a temperature of 34 deg. Fahr. for four days or less ripened normally at ordinary temperature and showed a rate of wastage no greater than that of tomatoes which had not been exposed to a low temperature. If, however, the period during which the tomatoes were kept at 34 deg. Fahr. was increased to six or more days the fruit failed to ripen normally after removal from storage and an unusually rapid wastage occurred. It also stated that tomatoes are injuriously affected by storage for more than a short time at temperatures below 50 deg. Fahr.

The injurious effects of storage at 34 deg. Fahr. is not reflected in rate of wastage while the fruit is kept at that temperature, but becomes apparent after removal to higher temperature. Storage at this low temperature would only be of value if consumption occurred before fungal rotting commenced, which may begin within twenty-four hours after removal from storage.

In a more recent publication—viz., "Tropical Agriculture" (B.W.I.), Vol. X., No. 6—Wardlaw and McGuire state that they found that tomatoes picked full grown but green could be successfully held in cold storage at 47.5 deg. Fahr. for periods up to twenty days, and thereafter ripened and held at 70 deg. Fahr. for ten to fourteen days without undue wastage. Fruit that had escaped fungal infection did not undergo deterioration on removal from cold store.

Barn Spot of Tobacco.

PRELIMINARY INVESTIGATIONS AND FLUE-CURING EXPERIMENTS.

By L. F. MANDELSON, B.Sc. Agr., Assistant Plant Pathologist.

FROG eye leaf spot and barn spot of tobacco are both the result of infection by the parasitic fungus *Cercospora nicotianæ.* The former blemish develops in the field, whereas the latter develops during curing, and is most pronounced at about 110° F. when the leaf is drying out. The various field aspects of this disease have been fully discussed elsewhere in this Journal.[4]

Frequently tobacco leaf is considerably damaged during curing through the development of barn spot, even when the amount of frog eye in the field is not very great. Hence it was realised that any modification of the curing process which would retard the development of barn spot would be of considerable economic importance. Consequently the nature of barn spot and the effect of variations of temperature and relative humidity upon the growth of the causal fungus and on the development of spots have been studied, with the ultimate object of lessening the development of the trouble during curing by a variation of curing practice. The results of this work form the subject of the present article.

Effect of High Temperatures Prior to Curing.

It has been reported that in some countries barn spotting is more or less controlled by subjecting tobacco leaf to fairly high temperatures prior to curing. Hopkins[2] states that some growers in Rhodesia run the temperature in the barns up to 160° F. as quickly as possible, and then rake out the fires and allow the barns to cool to the normal temperature prior to proceeding with curing in the usual way. Similarly, Butler[1] reports that in Nyasaland the extension of spots during curing is checked by raising the temperature of the barn for a time to 120° F. or more. He suggests that this method "probably acts rather by killing the leaf tissue than by injuring the fungus, which the temperatures reached would be quite unlikely to do." The development of the parasitic fungus is consequently checked, since it does not readily grow on dead materials.

In June, 1932, experiments were carried out in the Mareeba district by Mr. N. E. Goodchild, Instructor in Agriculture, at the suggestion of the writer, to test out this method.

In these experiments, two barns were used. One was kept at low temperatures and high humidity for the purpose of colouring the leaf, and the other was used for preliminary heating of the leaf prior to colouring. The temperature of the latter was first raised to 120° F. at the rate of one degree per minute. Sticks of leaf were exposed to this and higher temperatures up to 160° F. for various periods of time. After treatment the leaf was transferred to the colouring barn and coloured in the usual manner. For comparative purposes, some leaf was placed directly into the colouring barn without preliminary heating.

In the first experiment the temperatures used were 120° F., 130° F., 140° F., 150° F., and 160° F., and the periods of exposure varied from five to fifty minutes. It was found that the control leaf showed larger

and more numerous spots than that which had been subjected to a preliminary heating. The latter, however, was mostly scorched, and spotting developed to some extent.

In the second experiment efforts were made to raise the temperature more rapidly, to observe the effect of times of exposure other than those employed in the previous experiment, and also to confirm the results already obtained.

The greatest speed by which the temperature could be raised was 3° F. per minute. The same temperatures were used as above, and the period of exposure varied from one to twenty minutes.

It was found that five minutes' exposure at 130° F. gave rather good control, although the tips of the leaves were scorched. Ten minutes at this temperature was definitely too long, since the exposed portions of leaves were damaged. Scorching occurred at and above 140° F. when exposed for only three minutes or less.

From these experiments it was concluded that barn spotting could be controlled to some extent by this method, but that the danger of ruining the leaf by over-heating was too great to warrant its recommendation as a general control measure.

The following season further curing experiments along different lines were carried out. The principles involved were based upon the results of laboratory investigations. These studies and the subsequent curing experiments are discussed herein in some detail. It must be remembered, however, that the following is a progress report of preliminary work and that further investigations are contemplated.

LABORATORY EXPERIMENTS.

The two main factors involved in flue curing of tobacco are temperature and humidity, and both these factors may be controlled during the process. Hence laboratory experiments were designed to study the effect of variations of temperature and humidity on the growth of the fungus, which is the cause of frog eye, and on the development of spots on affected leaf tissue.

Temperature Reactions of C. nicotianae and Their Possible Significance in Spot Development.

Single spores of the fungus *Cercospora nicotianæ* were isolated from frog eye spots on tobacco leaves, and were grown on potato dextrose agar medium for the purpose of these investigations. Cultures obtained in this manner were incubated in fourteen compartments of a multiple temperature incubator at temperatures ranging from 5° C. to 37·5° C., at intervals of about 2° C. It was observed that the appearance of the fungus varied greatly at different temperatures. Striking differences were noted in the colour of the fungus, the nature of its growth, and the formation of vivid coloured zones.

Since temperature can be responsible for such variations when the fungus is grown on artificial medium, it seems quite likely that it would also cause variations in colour when the fungus is growing within a tobacco leaf.

Barn spots are usually brown, but at times they may be a greenish-black. Butler[1] has suggested that this unusual form may be "due to the special conditions of temperature and the like in the barns."

Furthermore, Hopkins[3] has recently reported that in Rhodesia the symptoms of frog eye leaf spot, which developed in the field in 1933, were abnormal, and attributes this phenomenon to "unfavourable weather conditions with which the crop had to contend." Similar variations of symptoms have at times been observed in Queensland. The above observations tend to support the possibility that temperature is at least one factor which may cause variations in the colour of leaf spots.

The effect of temperature on the growth of the fungus is graphically illustrated in Plate 31.

These temperature studies have indicated that *C. nicotianæ* will not grow on potato dextrose agar media at temperatures below approximately 7·5° C. (45·5° F.) or above 34° C. (93° F.), and that the optimum temperature for its development is about 26° C. (78·8° F.).

The upper limit of temperatures for growth (i.e., 93° F.) is particularly significant in an investigation of the development of barn spot during curing. Spotting has been observed to occur during flue curing when the temperature at the lower tier in the barn did not fall below 95° F. Nevertheless, under the conditions of the experiment reported above, the fungus which is the cause of this disease does not grow on artificial media at temperatures even slightly lower than 95° F. Possibly the temperature within the tissue of tobacco leaf in a barn differs from that of the surrounding air, or other conditions within the barn are such as may allow growth of the fungus at temperatures apparently above the maximum limit, and this may subsequently result in the development of barn spots.

On the other hand, it is likely that the fungus does not actually grow at all during the curing process. Spotting probably is due to infection which has occurred in the field, although development then has not advanced sufficiently to produce a spot which is clearly visible to the naked eye. Such tissue which has already been affected by the parasite may turn brown when the cells of the normal tissue are colouring and the leaf is being dried; consequently barn spotting would become apparent during this period.

Relative Humidity and the Development of Barn Spot.

In these experiments the relative humidity of an atmosphere was regulated by exposing a surface of distilled water or of various mixtures of water and sulphuric acid within a closed vessel, which contained the leaf tissue or culture being studied.

The effect of various relative humidities obtained in this manner on the growth of the fungus was first investigated. Cultures of *C. nicotianæ* were grown at a constant temperature in atmospheres which varied from 85 per cent. humidity to 100 per cent. humidity, but no significant difference in the rate of growth was observed.

Subsequently the development of barn spot lesions on tobacco leaf tissue was similarly studied.

Tobacco leaf, at various stages of maturity, showing frog eye lesions was obtained from the Sarina district. On arrival at Brisbane the leaf was cut into 4-inch squares, and the number of diseased spots in each square counted, and the limits of several marked with Indian ink.

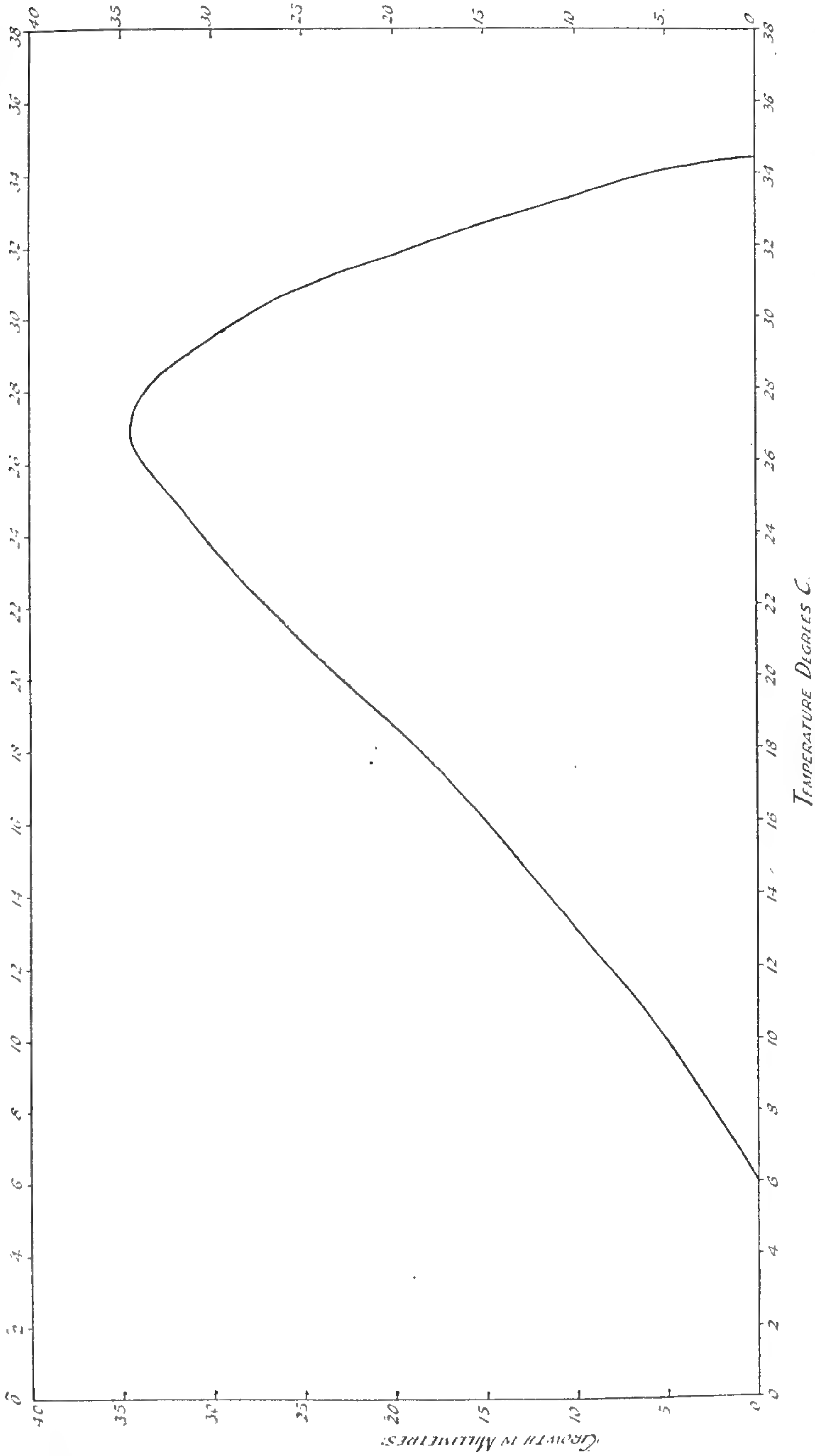


Plate 31.

Growth-temperature curve for *C. nicotianæ* after nine days' incubation. Averaged from data obtained from two series of experiments.

The leaf tissue was suspended in paper saddles in jars containing atmospheres adjusted to the required humidities. The relative humidities used were approximately 60, 70, 80, 90, and 100 per cent. The jars and leaf were placed in an incubator at 43° C. (109° F.).

The leaf was examined after forty hours. It was then found that fairly extensive development of spots had occurred at all humidities with over-mature leaf. Some spots had coalesced, and large brown areas had developed, which made the actual measurement of the extensions of spots difficult.

With less mature leaf it was found that the rate of development of the spots varied at different humidities. The average increases in diameter of the spots measured were as follows:—

At a relative humidity of 60 per cent. the increase was 3·0 mm.

At a relative humidity of 70 per cent. the increase was 3·5 mm.

At a relative humidity of 80 per cent. the increase was 3·0 mm.

At a relative humidity of 90 per cent. the increase was 4·7 mm.

At a relative humidity of 95 per cent. the increase was 5·4 mm.

At a relative humidity of 100 per cent. the increase was 4·1 mm.

It will be noted that a development occurred in all cases, but this development was greatest when the relative humidity exceeded 80 per cent. The development in a saturated atmosphere, however, was less than that at 90 per cent. relative humidity. The relative humidity of the atmosphere in a curing barn varies from about 86 per cent. to 96 per cent. during the early stages of curing; consequently these observations suggested that further investigation into the development of barn spotting at high relative humidity might be of practical importance.

At a later date, further leaf from the same source was obtained, and the experiment was repeated. The humidities used were 60, 80, 90, and 100 per cent. On this occasion, however, the leaf was incubated at a temperature of 34° C. (93° F.), since this more closely approximates the temperatures which obtain during the early stages of curing.

The leaf was examined after seventy-five hours, and it was found that the average extension of about thirty spots in each series was as follows:—

At a relative humidity of 60 per cent. the increase was nil.

At a relative humidity of 80 per cent. the increase was 0.5 mm.

At a relative humidity of 90 per cent. the increase was 1·2 mm.

At a relative humidity of 100 per cent. the increase was 0·3 mm.

In this case the development at 90 per cent. relative humidity was four times as great as that which occurred in a saturated atmosphere.

Discussion.

No great degree of exactness can be expected in experiments of this nature, since firstly the leaf material used varied in amount of infection and age, and secondly a considerable period elapsed from the time the leaf was harvested until it arrived in Brisbane. Nevertheless, the results indicated that (1) the more mature the tissue the more liable it was to the development of barn spots; (2) this development varied directly up

to a certain point with the relative humidity of the atmosphere in which the leaf was coloured; and (3) the greatest development of spotting occurred when the relative humidity of the atmosphere was at some point between 90 and 100 per cent., but decreased as the relative humidity approached saturation point.

The results of this preliminary work were encouraging, since they indicated that high relative humidity might to some extent check spot development. From the practical viewpoint this was important, since control methods involving a variation of relative humidity during curing would probably be less apt to cause injury to the leaf than one depending on extremely high temperatures.

FLUE-CURING EXPERIMENTS FOR THE CONTROL OF BARN SPOT.

During the past season, at the suggestion of Mr. J. H. Simmonds, Plant Pathologist, flue-curing experiments were carried out in the Sarina district in order to test the significance of the results which had been obtained from the preliminary laboratory experiments reported above. These experiments were made in conjunction with other duties, and consequently the time available was limited. Hence in these experiments, in order to rapidly test the available data, both temperature and humidity were appropriately regulated. Even so, it was only possible to carry out two series of experiments. Since some rather promising results were obtained, they will be discussed herein in detail.

As the conclusions are based on somewhat limited data, it will be necessary, however, to confirm these results during the coming season.

First Curing Experiment.

Since laboratory experiments had indicated (1) that the maximum temperature for growth of *Cercospora nicotianæ* in culture was in the region of 93° F., and (2) that the development of spots on tobacco leaf tissue was restricted in a saturated atmosphere, efforts were made during this experiment to colour the leaf at a temperature range above 95° F., and also to maintain as high a relative humidity as possible within the barn during this period.

Through the courtesy of Messrs. Gerry and Brooks, of Sarina, two of their 12 feet by 12 feet flue-curing barns and the required amount of harvested tobacco leaf were made available for the experiment. Useful advice and practical co-operation were rendered by Mr. C. S. Clydesdale, Senior Instructor in Agriculture, during the curing of these barns, and his efforts were greatly appreciated.

Since it was anticipated that "sponging," a blemish associated with variations in humidity during curing, might develop with leaf cured in an abnormally high relative humidity, the barns were not overloaded with leaf. Only five tiers were used, and the sticks were spaced so that no more than twelve sticks of leaf were hung in each row. Other precautions were also taken at the end of the yellowing period to avoid the development of this trouble.

The barns were filled with leaf by about 5 p.m. on 5th May, and curing operations commenced at 9 p.m.

The leaf in one barn (the control barn) was cured in the usual manner for comparative purposes, and that in the other was subjected to the high temperatures and relative humidity discussed above.

Details of Relative Humidity and Temperature.

In order to increase the relative humidity of the atmosphere within the experimental barn, steam was generated in a 40-gallon iron drum and led into a tub of water in the barn. Wet bags were also periodically placed on the hot flue pipes in the barn. In this manner it was hoped to colour the leaf in an actually saturated atmosphere. It was found impossible, however, to maintain saturation with the facilities available.

A 100 per cent. relative humidity was obtained in this barn during the first half hour and also on two other occasions during the first twelve hours, but could not be maintained for any length of time. The relative humidity exceeded 95 per cent. for only one and a-quarter hours during this period.

That of the control barn did not exceed 92 per cent. during the first twelve hours, and was slightly lower on the average.

For the remainder of the colouring period efforts to maintain a saturated atmosphere in the experimental barn were more successful.

During the same period the relative humidity of the control barn did not exceed 96 per cent., and exceeded 93 per cent. for only two hours, which was about 9 per cent. of the time under discussion.

While the leaf was colouring the temperature of the experimental barn fluctuated between 94° F. and 103° F., whereas that of the control barn varied between 85° F. and 96° F.

The temperatures and relative humidities which were recorded in these two barns during this period are shown by the graph in Plate 32.

Operations Subsequent to Curing.

The ventilators of the experimental barn were opened twenty-eight and a-half hours after curing commenced, whereas those of the control barn were cracked after thirty-three hours. Hence the higher relative humidity and temperature of the former apparently accelerated the colouring process by about five hours.

The moisture in the experimental barn was expelled as rapidly as possible at the termination of the colouring process, as a precaution against the development of "sponging." At Mr. C. S. Clydesdale's suggestion, when the leaf was sufficiently coloured the temperature was rapidly raised 5° F., the top ventilators were opened wide and the lower ventilators were half opened for forty-five minutes. Consequently, the relative humidity was lowered from 96 per cent. to 51 per cent. during the first four minutes, and eventually to 49 per cent. At the termination of this period the top ventilators were closed to a third and the bottom ventilators to a quarter, and the curing was continued in the usual manner.

Observations on Barn Spot Development.

Barn spotting was observed to develop in both barns after about twelve hours' curing, and subsequently increased in severity, and was very obvious seven hours after the ventilators were opened. During the first twenty-four hours, however, spotting did not appear to be so severe in the experimental barn as in the control barn.

At the termination of the experiment there was no marked difference in the amount of spotting which had developed on the leaf from either barn. Nevertheless, it was considered, after a careful examination, that the leaf from the experimental barn was slightly less spotted than that

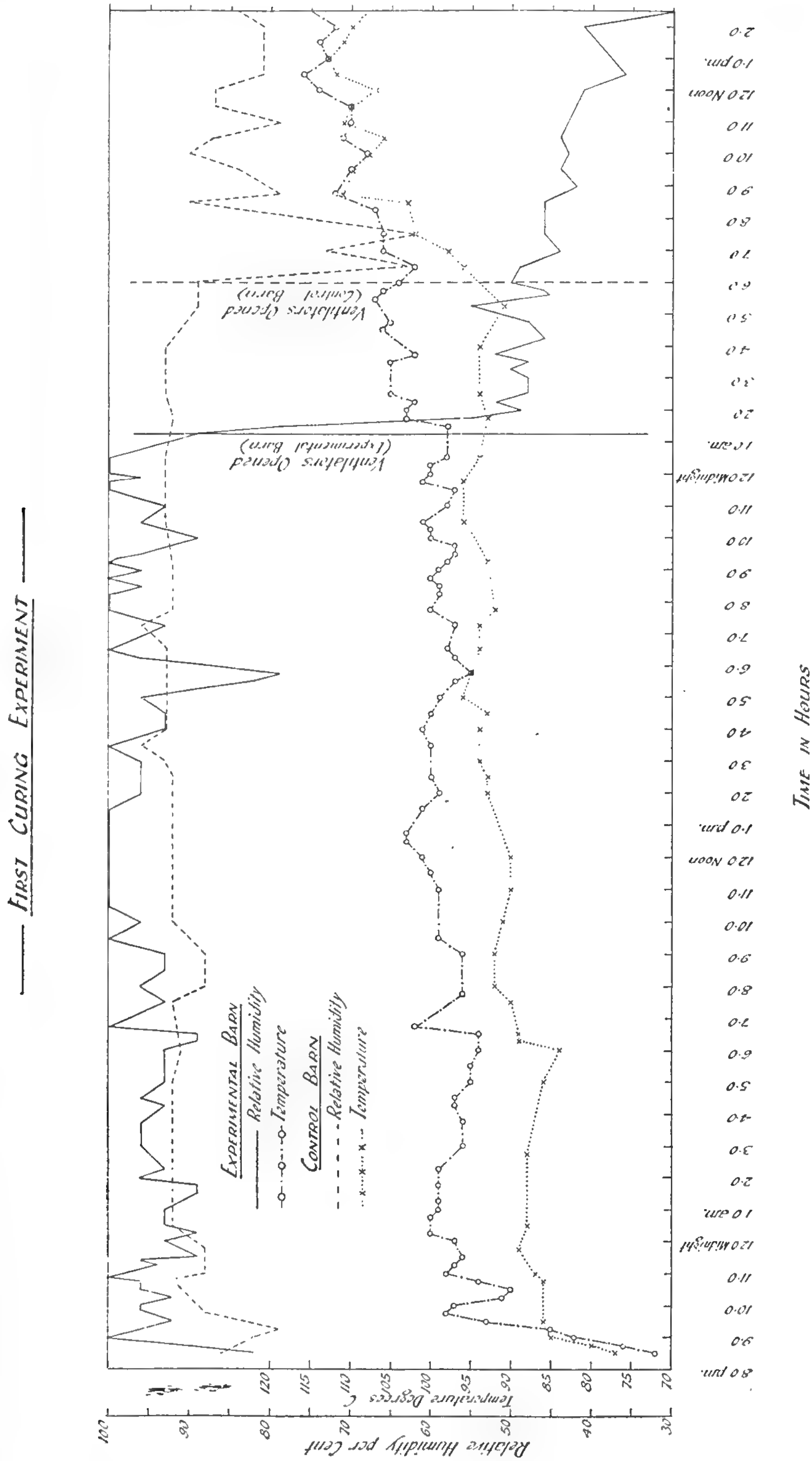


PLATE 32.

First curing experiment. Graph showing relative humidity and temperature records obtained in both the experimental and control barns during the period when leaf was colouring.

from the control barn, and the colour of the leaf was brighter and showed less "sponging." During the experiment several faults were detected in the construction of the barn, which made it extremely difficult to maintain a high degree of humidity. Consequently, it was considered that in view of the conditions under which the experiment was carried out, the results were slightly promising, and warranted the repetition of the experiment.

Second Curing Experiment.

On 8th June the experiment described above was repeated. Besides one experimental and one control barn, in which careful records of temperature and humidity were made, a third barn of leaf was cured normally at the same time, the final result only in this case being observed. On this occasion special precautions were taken to render the experimental barn as air-tight as possible prior to the commencement of the experiment. The facilities for the generation of steam were the same as employed previously.

The thermometers were suspended from the lower tier, and the leaf hung on this tier was carefully graded and labelled prior to curing. Five grades were recognised—namely, clean leaf, which showed no readily observable spots by reflected light; slight infection, when leaves contained one or two spots; light infection, when four or five spots were noticed; medium infection, when about twenty spots were present; and, finally, heavy infection, when numerous spots were apparent. Some leaf graded in this manner also showed incipient frog-eye lesions as minute spots when viewed by transmitted light.

Details of Relative Humidity and Temperature.

After the first three hours of curing, the temperature of the experimental barn did not fall below 98° F. during the colouring process. The maximum temperature reached was 108° F. On the average the temperature for this period was a little over 100° F. The temperature of the control barn varied from 82° F. to 100° F., and on the average was about 10° F. lower than that of the experimental barn.

A saturated atmosphere was obtained on twelve occasions during the first twenty-four hours in the experimental barn, and was maintained for periods up to two and a-half hours. The relative humidity only fell below 90 per cent. on two occasions, and then for periods of less than a quarter of an hour. The relative humidity was either at or above 96 per cent. continuously for fourteen hours during the first twenty-four hours of curing, except for one period of half an hour and another of forty-five minutes. This degree of relative humidity was maintained for ten and a-half hours of the first twelve hours of the experiment.

The relative humidity varied from 85 per cent. to 96 per cent. in the control barn during the first twenty-four hours. It did not exceed 96 per cent., and only maintained that registration for half an hour during this period. It was above 92 per cent. for eleven and a-half hours, and two-thirds of this time was recorded during the first twelve hours of the experiment.

Temperature and relative humidity records for this experiment are illustrated by graphs in Plate 33.

The leaf coloured more rapidly in the experimental barn than in the control barn, and the ventilators of the former were cracked ten hours sooner than those of the latter.

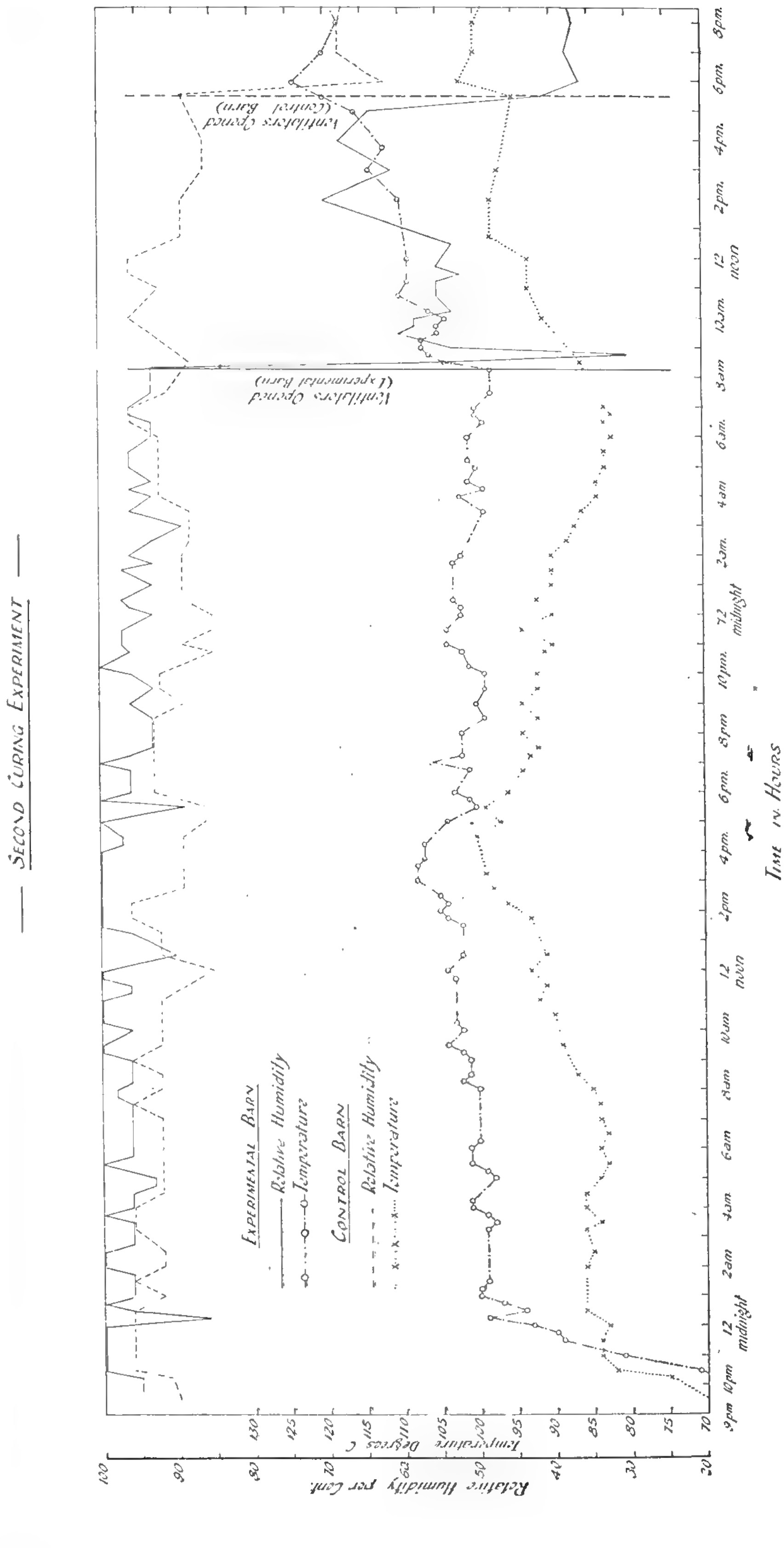


PLATE 33.

Second curing experiment. Graph showing data similar to Plate 32. The development of barn spot in the experimental barn in this case was considerably retarded.

Although special precautions were taken to make the experimental barn as air-tight as possible, it was found extremely difficult to maintain a sufficiently high percentage of relative humidity with the steam generating apparatus used. It will probably be found necessary in future, therefore, to employ some type of portable boiler for this purpose.

Observations on Barn Spot Development.

As in the previous experiment some barn spot development was observed in both barns after about twelve hours' curing.

When the leaf had been cured, it was found that that from the experimental barn was obviously less spotted, and the spots usually showed less development than leaf from the control barn, or from the third barn in which leaf was also cured in the manner usually practiced. Furthermore, less "sponging" occurred in the experimental barn.

Leaf which was clean, or slightly or lightly spotted prior to curing in the experimental barn developed only a few small spots in some cases, and mostly showed no development (Plate 34). Similar leaf from the control barn was mostly moderately to heavily spotted, although some leaves were unblemished at the termination of the experiment. The latter were probably not affected with the disease when harvested.

Leaf which showed medium infection prior to curing developed more spotting in the control than in the experimental barn. About 70 per cent. of this leaf was finally moderately to heavily spotted in the control barn as compared with about 50 per cent. moderately spotted in the experimental barn.

No great difference could be observed in the final condition of leaf which was heavily spotted prior to curing, although that from the experimental barn was slightly superior.

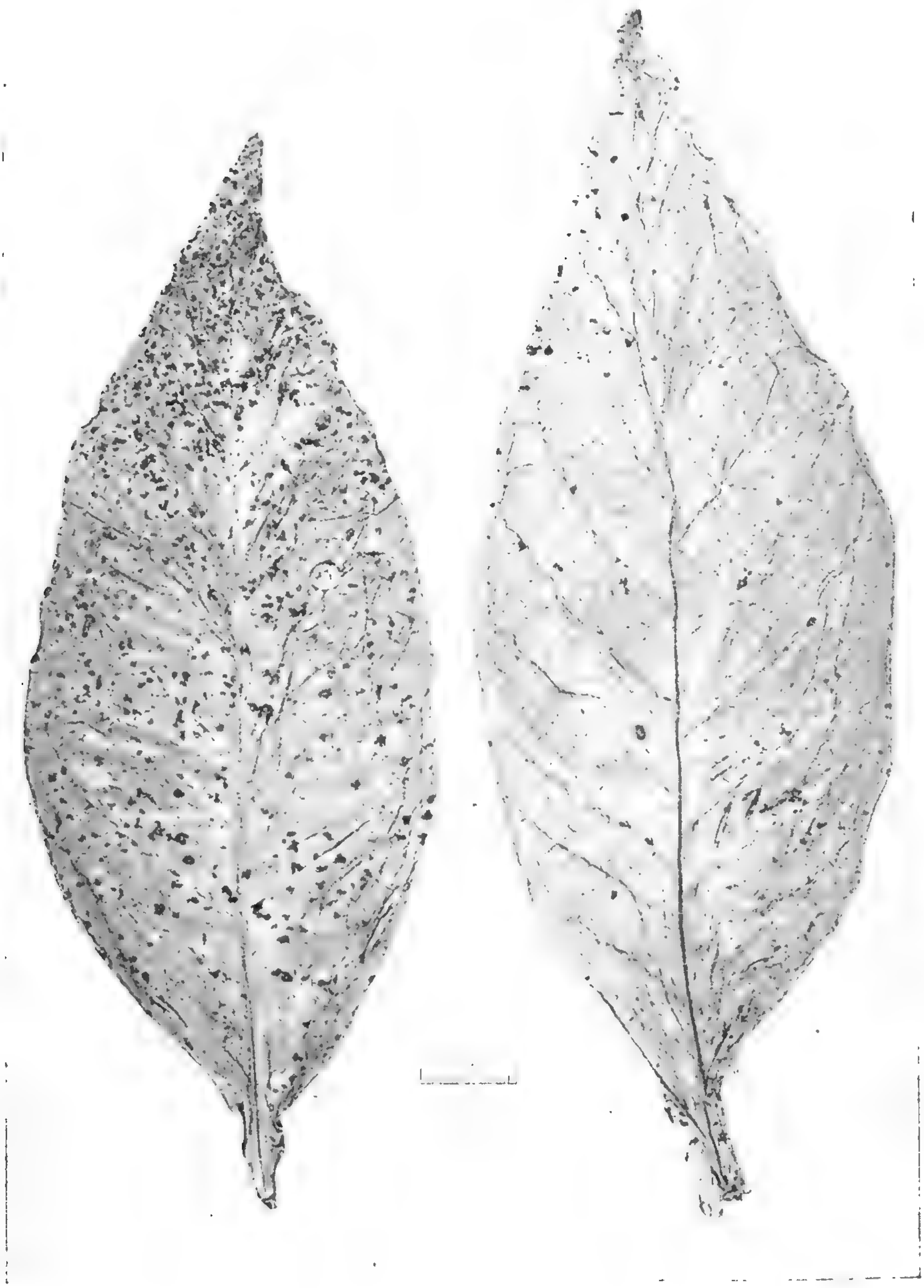
Hence quite a striking improvement was obtained with leaf cured in the experimental barn, which had less than about half a dozen spots apparent prior to curing. With leaf which was originally more heavily spotted the improvement was not so marked. This striking contrast was made possible by the fact that environmental conditions were particularly favourable at the time of the experiment for the development of the disease.

Since the temperature varies considerably at different heights in a barn during curing, a comparison was also made of the amount of spotting which had developed on leaf from various tiers in each barn. No obvious difference, however, could be observed in either case.

Discussion of Results of Curing Experiments.

As has been pointed out elsewhere, this work was of a preliminary nature; nevertheless, since the results obtained in the final experiment were rather striking, it is considered that it may be beneficial to analyse that data which is available.

Five important factors were involved in the experiments under discussion—namely, the condition of the leaf used, the rapidity with which the leaf was dried out after colouring, the time taken to colour the leaf, and the temperature and the relative humidity which obtained in the barn during the colouring process.



A. B.

Plate 34

Two tobacco leaves cured during the second curing experiment. Both showed "light" frog-eye infection (i.e., four or five spots) prior to curing.

A. Cured leaf from control barn, showing extensive development of barn spot.

B. Cured leaf from experimental barn, showing very little development of barn spot. Leaves which were clean or "slightly" spotted developed even less barn spot in this experiment.

The first is of no importance since similar leaf was used in both control and experimental barns. Furthermore, it is hardly likely that the outstanding results of the second experimental barn were entirely due to the unusual rapidity of drying the leaf after colouring. The temperature of this barn was 130° F. with a relative humidity of 30 per cent. twenty-seven hours after the ventilators were cracked, whereas the control barn reached a temperature of 133° F. with a relative humidity of 26 per cent. in twenty-nine hours—i.e., only two hours longer. Moreover, a graph showing the relative humidity of the two barns illustrates that the slope of that of the control barn is steepest, and hence that during some of this period at least the leaf was drying more rapidly in the control barn than in the experimental barn.

The combination of high humidity and high temperature within the experimental barns certainly accelerated the colouring of the leaf—namely, by four and a-half hours in respect to the control barn in the first, and ten hours in the second experiment. It will be noted, however, that the actual times for colouring were—Test barns twenty-eight and a-half hours and thirty-four hours, control barns thirty-three and forty-four hours, respectively. The longer periods taken in the second series were due to the fact that they were carried out late in the season, when cool weather was being experienced. It would seem from these figures, therefore, that spotting was not avoided in the experimental barns by rapidity in colouring. Although the experimental barn in the second series coloured the leaf ten hours quicker than the control barn, the actual period taken was thirty-four hours, which was in fact one hour longer than the time taken by the control barn in the first series, when considerable barn spotting occurred.

The temperature of the second experimental barn was considerably higher than those of either of the control barns. It was also, on the average, a few degrees higher than the temperature of the first experimental barn, and for a period of one and a-half hours was 7° F. or 8° F. higher. Consequently, since the second experimental barn was much more successful than the first, temperature may have been the limiting factor. Such is hardly likely, however, since during curing the temperature of the top tier may vary by about 10° F. from that of the bottom, and hence a considerable range of temperatures obtains within a barn. It was not possible, with the facilities available, to take temperature readings at various heights during these experiments, but it would be likely that the temperature of the coldest portion of the second experimental barn would be lower than that of the warmest portion of the first experimental barn for a considerable period. Hence if the temperatures reached during these experiments were responsible for the results obtained, then better results would have been observed in some tiers in the first experimental barn, or the amount of spotting would have varied considerably with leaf from different levels in the second experimental barn. Such, however, was not the case.

The most likely reason for the better control of spotting obtained with the second experimental barn was probably the high relative humidity which was maintained when the leaf was colouring, especially during the initial stages of the process. As has been indicated above, the relative humidity of the second experimental barn was either at or above 96 per cent. practically throughout the first twelve hours of curing, whereas that of the first experimental barn only exceeded 95 per cent. for one and a-quarter hours during this period.

The percentages of relative humidity which were recorded in the four barns under discussion for the first twelve hours of curing have been critically analysed, and the total times that the leaf was exposed to various humidities have been grouped together, in each case, and are graphically depicted in Plate 35.

It will be noted that the leaf in the second experimental barn was exposed for much longer periods for all relative humidities in excess of 95 per cent. than that of the first experimental barn, as is illustrated by the difference in the heights of the two columns. The differences are even more striking when the relative humidity of the second experimental barn is contrasted with that of the two control barns for the same period.

It therefore appears reasonable to believe that the difference in relative humidity may have been the main factor responsible for the better results obtained in the second experimental barn.

Further investigations will be carried out to determine the effect of high relative humidities on the development of barn spot Should this prove to be the limiting factor, it will then be desirable to ascertain the minimum percentage of relative humidity permissible in a barn during the colouring process or for any part of it, to most effectively control the development of spotting.

If the results obtained from these proposed experiments are satisfactory, then it should be possible to make definite recommendations for the control of barn spotting by variations of curing methods as practised at present.

Summary.

Barn spot of tobacco is caused by *C. nicotianæ,* and develops during the tobacco-curing process.

When tobacco leaf was heated to about 130° F. the development of barn spot was controlled to some extent, but the danger of ruining the leaf by over-heating was too great to warrant the recommendation of this procedure for general use.

The nature of the growth of *C. nicotianæ* varies considerably when grown on artificial media at different temperatures.

The optimum temperature for its growth on potato dextrose agar was found to be approximately 26° C. (78·8° F.). The minimum and maximum temperatures for growth were 7·5° C. (45·5° F.) and 34° C. (93° F.) respectively.

Since barn spot may develop during the curing process at temperatures greater than 93° F., it is considered likely that barn spot is not the result of growth of *C. nicotianæ* during curing, but is due to the reaction at this time of cells which have been affected by the parasite in the field.

No significant difference was observed in the growth of *C. nicotianæ* on artificial medium when grown in atmospheres of various relative humidities.

It was found that the more mature the tobacco leaf tissue, the more liable it was to the development of barn spot.

Humidity studies indicated that the development of barn spot varied, up to a certain point, directly with the relative humidity of the

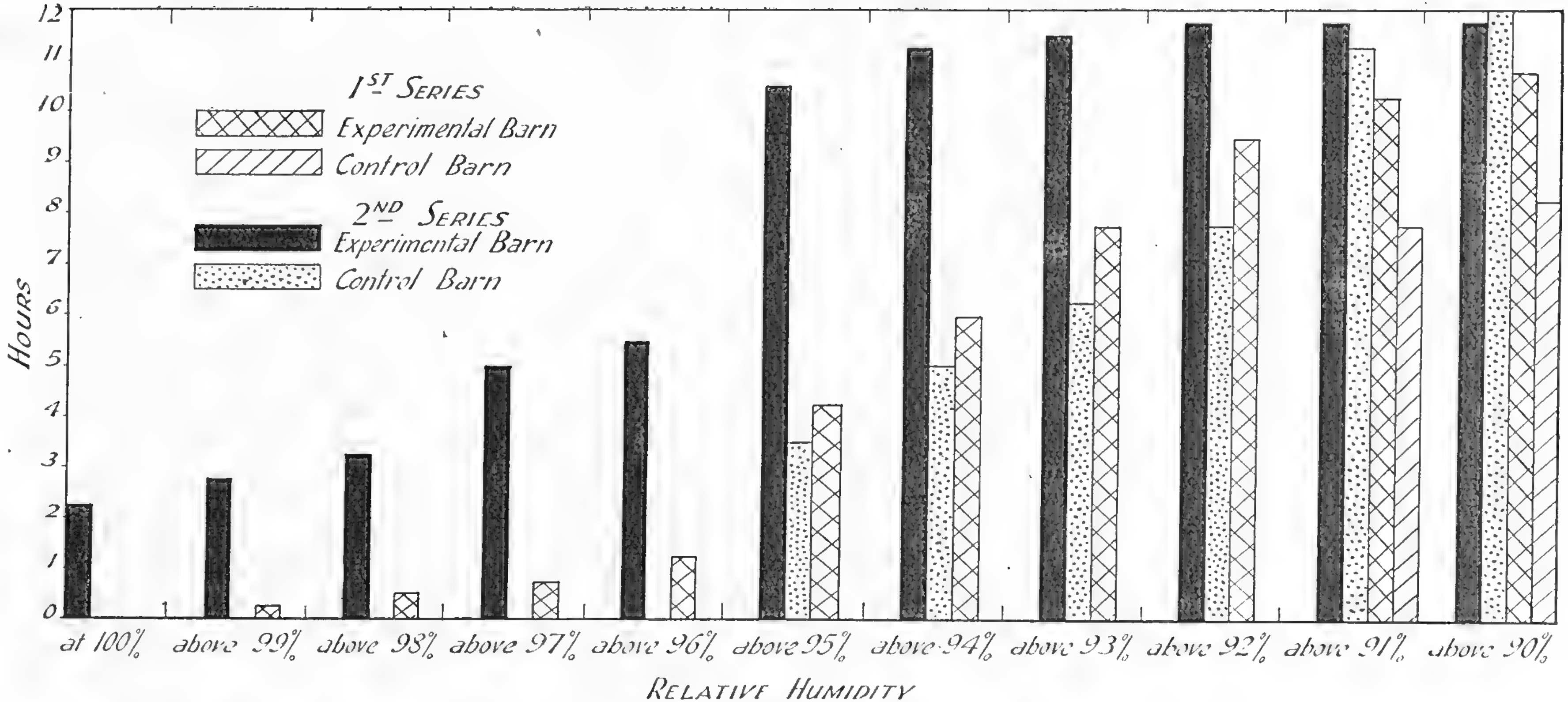


PLATE 35.

Diagram showing the periods for which tobacco leaf was exposed to various humidities during the first twelve hours of the curing experiments.

It will be observed that the relative humidity within the experimental barn in the second series was above 95 per cent. for a much longer period than was the case with the other three barns.

atmosphere in which the leaf is coloured. The development was less in a saturated atmosphere, however, than when the relative humidity was 90 per cent.

Two flue-curing experiments were carried out with commercial curing barns in the Sarina district.

Difficulty was experienced in maintaining a high percentage of relative humidity with the facilities available.

In both experiments the colouring process was considerably accelerated, and the leaf was not adversely affected by the increased humidity and temperature of the barns.

In the second experiment the temperature in the experimental barn varied from 98° F. to 108° F., and the relative humidity of the atmosphere was either at or above 96 per cent. for fourteen hours during the first twenty-four hours of curing.

Leaf cured in this barn developed considerably less barn spot than similar leaf cured in the usual way.

It is considered, tentatively, that the most likely reason for this result was the high relative humidity which was maintained when the leaf was colouring, especially during the initial stages of the process.

It is proposed to carry out further experiments along these lines.

Acknowledgments.

Acknowledgment is made to Mr. J. H. Simmonds, Plant Pathologist, Department of Agriculture and Stock, Queensland, for the active interest shown and useful suggestions made in connection with this work, and to Messrs. Gerry and Brooks, Sarina, for the pathological specimens supplied, and for personal assistance and flue-curing facilities at Sarina.

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The Cultivation of the Peanut.

By N. A. R. POLLOCK, Senior Instructor in Agriculture.

Description.

THE Peanut, *Arachis hypogeia,* also known frequently as the earth or ground nut, is a plant of annual habit, belonging to the natural order Leguminoseæ or pod-bearers, and in common with most other members of the pea family has the power of obtaining its nitrogen supply from the atmosphere and storing it up in nodules on the roots.

Unlike other legumes, excepting the Bombarra ground nut, *Voandzeia subterranea,* and one or two others, this plant, while blooming above ground, matures its pod or fruit under the surface of the soil. The yellow flowers are borne at the joints where the leaves are attached to the stem, in the bunch or upright varieties at the base of the plant, and in creeper or procumbent varieties right along the stems. Upon pollination taking place the flower fades, and falling off leaves the stalk with a thickened pointed end called the "peg" or "point," which grows down into the soil, where it matures into the pod or so-called nut. It is apparent from this that the soil on which the crop is grown should be of a soft or friable nature or such that a loose surface can be easily maintained.

Range.

The peanut can be grown over the whole of Queensland, and while in the cooler parts it only succeeds in summer, in the tropical portions it may be grown at any period of the year where a sufficiency of rain falls.

The period of growth ranges according to variety and climate from fifteen to twenty weeks, the longest period being taken up by the creeper or procumbent varieties.

A moderate rainfall, plenty of sunshine, and a comparatively high temperature best suit the crop, and departures from these may result in a more lengthened period of growth. The crop can also be grown under irrigation.

Soils.

The nature of the soil on which the crop is grown, besides its fertility, is the main factor in a profitable crop. A loose texture is desirable to allow the pegs to easily penetrate and expand to form the pods and mature evenly, as well as to permit of easy harvesting in freeing the nuts from the soil. Good drainage is also essential, more especially when a heavy rainfall is liable to occur during the growing period.

Light sandy loams with a good humus content are best adapted for the production of peanuts for sale as whole nuts, since the shells, being clean and bright, are more attractive.

Soils in which the percentage of iron is high and those of clayey nature are apt to produce stained or dirty shells, and though the berries or peas may be of equal or even superior quality, the discoloration is calculated to prejudice sale. When, however, the product is sold in the shelled condition, as to confectioners, this defect is of minor consideration. Ill-drained, heavy clays and soils which become hard and compact should be avoided.

A suitable mechanical character is the first essential in a soil for peanuts, as fertility can be improved by the judicious use of manures and a proper system of cropping.

Depth of Soil.

A soil of a foot or upwards in depth is to be preferred, especially in districts of abundant rainfall, but lesser depths down to 8 inches, provided the subsoil is of a porous nature, will allow of successful production.

Preparation of the Soil.

As the success of the crop is in large measure dependent on the tilth maintained during growth, it is important that the preparation of the soil prior to planting should be thorough.

In the case of virgin soil or land that has been under pasture and where the roots of the preceding crop have not been disturbed, it is desirable to plough a considerable time before sowing is contemplated, in order that any growth ploughed under as well as fibrous roots will have time to decay.

Where this has been effected or a previous crop has left the land clean, a ploughing three or four weeks before the time of planting with an immediate harrowing to create a good tilth and to conserve moisture is desirable. Periodic harrowing during these weeks while further promoting tilth will destroy weeds as they germinate and permit of sowing in a clean seed-bed.

Depth of Ploughing.

As a general rule, the depth of ploughing should not be as great as for potatoes or maize in the same locality. From 5 to 6 inches is regarded as adequate, but deeper ploughings, provided no subsoil is brought to the surface, are not regarded as detrimental.

Fertilizers and Lime.

In common with other legumes, the peanut thrives best in a soil in which there is a sufficiency of lime. Not all soils require the addition of lime, but most soils in districts subject to heavy rainfall, and which give an acid reaction, will benefit by an application of from 5 to 10 cwt. of stone lime or 10 to 20 cwt. of earthy lime or pulverised limestone to the acre, broadcasted (not ploughed in), preferably a week or more before applying commercial fertilizer and sowing the seed. The cultivation of the crop will sufficiently work this lime into the soil. Where any doubt exists as to the necessity of applying lime to the soil, a portion should be limed and the resultant crop compared with a similar area unlimed.

In applying manures for the crop, care should be taken to only apply organic manure in a well-rotted condition, and then only in small quanties and thoroughly mixed with the soil. Larger quantities of fresh manures will result in many of the pods being poorly filled. These poorly-filled pods are known as "pops" or "duds."

Organic manures such as that from the farmyard are better applied for a previous crop. Where growing crops are ploughed in to augment or maintain the supply of humus, it is also better to grow an intervening crop.

The supply of humus in the soil is of great importance to all crops, as not only is the soil mechanically benefited but it preserves a more even temperature and is more retentive of moisture. Bacterial multiplication is also assisted and the supply of plant food improved.

As the peanut is a legume and draws much of its nitrogen from the air this element is not called for in great quantity in the fertilizer, especially when the soil is fairly well supplied with humus and decaying organic matter. On most soils, however, its presence in immediately available form is desirable to allow the plants to become well established.

Phosphoric acid and potash are the chief elements demanded in the fertilizer mixture, of which the rate of application will be determined by the natural fertility of the soil.

An ample supply of phosphates in the soil stimulates root development and causes the crop to mature more rapidly and evenly. It is also necessary to allow the nitrogen-fixing bacteria to assume the motile form and thus to become capable of invading the young roots.

On loamy soils, such as those in which maize and potatoes return profitable crops, the necessity for applications of fertilizer is not urgent, yet a supply in small quantity can be calculated to induce a greater profit. On such soils, however, the fertilizer should containly only a small percentage of nitrogen, and this in a readily available form.

A mixture of 10 lb. nitrate of soda or sulphate of ammonia, 70 lb. high-grade superphosphate, and 20 lb. sulphate of potash for each 100 lb. would be considered suitable. This mixture would contain 1·5 per cent. nitrogen if nitrate of soda was used, or 2 per cent. nitrogen if sulphate of ammonia was used; the percentage of phosphoric acid would be 14·35 and that of potash approximately 10. Such a formula might be expressed as 2-14-10.

On poorer soils, and especially those of sandy character, recommended for the production of bright tobacco, in which the humus content is generally low, the application of a fertilizer carrying a somewhat higher percentage of nitrogen is desirable.

On sandy loams a mixture of 20 lb. sulphate of ammonia, 60 lb. high-grade superphosphate, and 20 lb. sulphate of potash would be suggested.

On sandy soils a mixture of 15 lb. dried blood, 13 lb. nitrate of soda, 60 lb. high-grade superphosphate, and 12 lb. sulphate of potash would be more advisable, as the organic matter of the dried blood would be of assistance and its nitrogen content become readily available when the nitrate was exhausted. This latter mixture is the popular 4-12-6 tobacco mixture. The former would be expressed as 4-12-10 and the first named as 2-14-10, the numerals in their order representing percentages of nitrogen, phosphoric acid, and potash respectively.

When the drills are 3 feet apart, a collective length of 220 chains constitutes an acre, and when 2 feet 6 inches apart such collective length would be 264 chains.

Dressings of fertilizer from half a pound per chain at the rate of 110 lb. and 132 lb. respectively per acre would be suggested on a fairly fertile sandy loam, up to 2 lb. per chain or 440 lb. and 528 lb. respectively on a poor sandy soil. Generally, however, a dressing of 1 lb. per chain of drill should be ample.

On certain fertile soils applications of superphosphate only at the rate of half a pound per chain of drill might be sufficient.

Commercial fertilizers are usually applied immediately prior to planting a crop, and as the roots of the peanut do not spread to any distance, the application in the drill with a fertilizer distributor having one or two tines at the back will greatly aid in mixing the fertilizer with the soil.

Ashes from the forest hardwoods, which contain lime and potash, are useful, and may be applied to the soil broadcast in a similar manner to lime at the rate of about 10 cwt. to the acre. These ashes, however, should not previously have been exposed to rain, as then a great deal of their value will have been lost. The ashes of soft woods growing in the scrubs are not considered so good.

Selection of Seed.

As with other crops, in order to secure the best results it is essential that the seed of the peanut should be of the highest grade. Poor seed cannot be expected to yield a good return. In the first planting, seed should be secured from a heavy producing crop and subsequently carefully selected in the field from the heaviest producing plants of the required type. A good plan is to select the nuts from the best producing plants and sow these in a special seed patch, each year selecting the best of this area for next year's seed patch. Nuts harvested for seed should be fully matured, handled carefully, and not picked from the plants for several weeks after curing; they should then be picked by hand and the selected ones thoroughly dried and stored in a dry place free from mice or insect attack. Storage in tanks in a similar manner to maize is most satisfactory.

Quantity of Seed.

The quantity of seed required to plant an acre is about 40 lb. of the whole nuts and from 25 to 30 lb. of whole nuts shelled, varying slightly according to the weight of the nut and the distance apart they are planted. Some growers use as much as 60 lb. per acre of the large podded varieties. It is interesting to note that the whole nut, when planted, provides but one plant, but if shelled and the kernels planted apart, two plants will result.

Time of Sowing.

According to the climates of the various districts, so will the time for planting vary.

In the cooler districts, sowings may be made when all danger of frosts is over and the soil can be expected to be reasonably warm, September, October, November, and December being suitable months. In the tropics the crop can be grown practically throughout the year, but consideration must be given to climate and rainfall—i.e., sufficient rainfall should be obtained to grow the crop and fine weather be expected at harvest time.

In the tropical portions of the State, where the monsoonal rain or wet season commences in December, the main crop is sown in January, February, and March, according to the likelihood of reasonably fine weather in the months of April, May, and June or July, when harvesting should occur.

In planting large areas it is recommended to spread the sowings over such a time as will allow of harvesting one lot before the next is over-ripe. Peanuts left too long in the ground are easily detached from the plant and consequently more difficult to harvest, while some varieties are liable to sprout.

Length of Crop.

The large nuts or creeper varieties require a longer time for growth to maturity than do the bunch or upright varieties, the time varying from fifteen to seventeen weeks for the bunch varieties and from seventeen to twenty weeks frequently for the creeper variety.

PLATE 36.
Peanuts at Warren, Central Queensland.

Method of Planting.

The land having been ploughed and brought to a fine tilth should be given a harrowing immediately prior to planting to destroy any weeds or their germinating seeds.

In general, drills are drawn out from 30 inches to 42 inches apart, the distance being influenced by the space required for the cultivating implement available.

Where no seed drill or fertilizer distributor is obtainable, the drills could be drawn out with a plough or a cultivator having a wide shovel attachment in the rear, the fertilizer dusted along this by hand, the cultivator then run along the drill with tines set close in front to mix the fertilizer with the soil, and the shovel attachment set at the back to reopen the drill for the reception of the seed to be dropped by hand; this drill should not be deeper than 4 inches from the levelled surface of the soil, and the seed should be covered to a depth of 2 to 3 inches,

according to the texture of the soil and its moisture content. In light soils where evaporation is great the deeper planting is preferable, but in stiffer soils the shallower covering should be adopted.

A light firming of the soil over the seed is desirable, and this is obtained in the seed drill by a wheel at the rear. When planted by hand the area may be covered with the harrow, or preferably by the cultivator, with tines straddling the drill and set so as to throw the soil inwards.

Most corn planters can be supplied with plates or other devices specially adapted for sowing either whole or shelled nuts.

The seed can either be planted whole or shelled. Whole nuts may be soaked in cold water twelve to twenty-four hours, drained, dried for an hour or two to assist handling, and then planted. This accelerates germination. Shelled seed should not be soaked.

Where shelled seed is used the shelling should be done by hand, though hand shellers carefully worked are sometimes used. All shelled seed in which the thin skin covering the seed is broken should not be sown, as this injury is liable to affect germination.

Breaking the pods in two answers the same purpose as shelling. Where the seed after planting may be subject to attack by vermin, the seed may be treated by sprinkling with a solution of equal parts of stockholm tar and kerosene. In this case, however, to protect the maturing crop it is advisable to destroy, by poisoning, the vermin beforehand.

Spacing.

The intervals between drills and the spacings between seeds in the drills vary somewhat, according to the richness of the soil and the variety planted.

The bunch or upright varieties take up much less room than the creeper or procumbent kinds, and the growth of both is correspondingly greater on the richer soil.

The spacing of the seed in the bunch varieties may be from 6 to 12 inches apart, and of the creeper varieties from 12 to 24 inches apart in the drill. An instance of success with close planting is noted from an experiment in which, in a light sandy loam, the bunch varieties were planted 3 inches apart in drills 30 inches wide. It is thought, however, in richer soils this crowding of the plants would be detrimental.

Time of Germination.

Germination usually occurs with shelled nuts in five days, but is subject to the amount of moisture and heat in the soil. The whole nuts take longer unless first soaked in water, as the moisture has to penetrate the shell to affect the berry or pea which contains the germ.

Cultivation.

Where close planting has been adopted the land may be harrowed with a light harrow shortly after the plants appear through the surface. Otherwise it will be better to use the cultivator between the rows and the hand hoe, where necessary, between the plants. The first one or two cultivations should be done with fine points, as in the strawberry cultivator or the 1¼-inch or narrowest shovel points supplied with the usual 5-tooth cultivator; after this the broader points can be used and

later the hilling attachments. In early cultivations the cultivator can work close to the roots, but not deeper than 2 inches; but later, after flowering, when the pegs enter the soil care should be taken that the plant is not disturbed.

In most soils it is desirable to draw a little of the soil in towards the plant to provide a bed of fine earth in which later the pods may form, and this can be done at each cultivation, finally leaving a flat bed in which the plants are growing with a water furrow between each drill. The height to which hilling may be practised depends largely on the soil. Usually, the heavier the soil the more necessity for hilling.

Soil should not be thrown on the centre of the plant, the object of hilling being to provide fine soil for the pegs to enter and mature evenly and for ease in harvesting. As a rule, in the creeping varieties the pegs easily reach the soil, but in certain cases a light roller run over the crop will facilitate this operation. In the bunch or erect growing varieties no rolling should be attempted, but a final higher hilling made if it is noticed the points have some distance to go to reach the soil.

Cultivation should be thorough, and an endeavour made to keep the soil in a loose and friable condition, especially around the plants.

Harvesting.

The time for harvesting is noted in the appearance of the foliage, which starts to yellow or lose colour, and by examination of the nuts. If the majority of the berries or peas are full grown and the inside of the shell has begun to colour and show darkened veins, the crop is mature and harvesting should not be delayed.

If the crop is harvested too early the proportion of "duds" is very great, while if deferred too long some of the nuts may germinate and others become detached from the plant when lifting, while the tops, having lost most of the leaves, will be of much less value for fodder. In some soils, notably the friable chocolate volcanic loams, the plants may be lifted by hand, when most of the nodule-bearing rootlets are left behind and only the root stock with the nuts is lifted. In other cases it is necessary to loosen the soil before lifting out. In small areas this is sometimes done with the digging fork inserted under the plant, which is lifted while the fork is worked underneath. In large areas a potato digger with an endless belt elevator from the shovel point is found very effective where the soil is dry enough to fall through the slats of the elevator and the crop is free from weeds.

An ordinary single-furrow mould-board plough with a 10 or 12 inch share is effective when the mould-board is removed, an improvement being found in the substitution therefor of some finger-bars which allow most of the soil to pass through and leave the vines and nuts uncovered.

A very satisfactory digger could, however, be made on the farm or by a local blacksmith by attaching to an ordinary wooden plough beam a knife edge to go under the plant and cut the roots just below the nuts; finger-bars at the rear of this knife edge would lift the plants and loosen the earth, thus facilitating the lifting by hand. The width of the knife edge should be sufficient between the attaching portions to the beam to allow of the whole plant passing through, and the depth should be regulated by the wheel or wheels in front. Perhaps a better idea might be given by taking the back off an ordinary earth scoop, together with

all the bottom excepting 6 inches in front, and substituting finger-bars slightly elevated to carry the plants and attaching the whole to a plough beam with handles. In a digger of this description, where one horse is used, the digging attachment would be to one side of the beam, while with two horses it would be in the centre, the operator straddling the row and the depth-regulating wheels being preferably two, one on each side of the line of plants.

It should always be remembered that the cutting of the roots as close to the pods as possible results in the greater quantiy of nitrogen being returned to the soil.

Harvesting should not begin until the dew is off and the tops are dry, and the operation should be regarded as a hay-making of the tops, and not more than can be handled should be lifted in any one day.

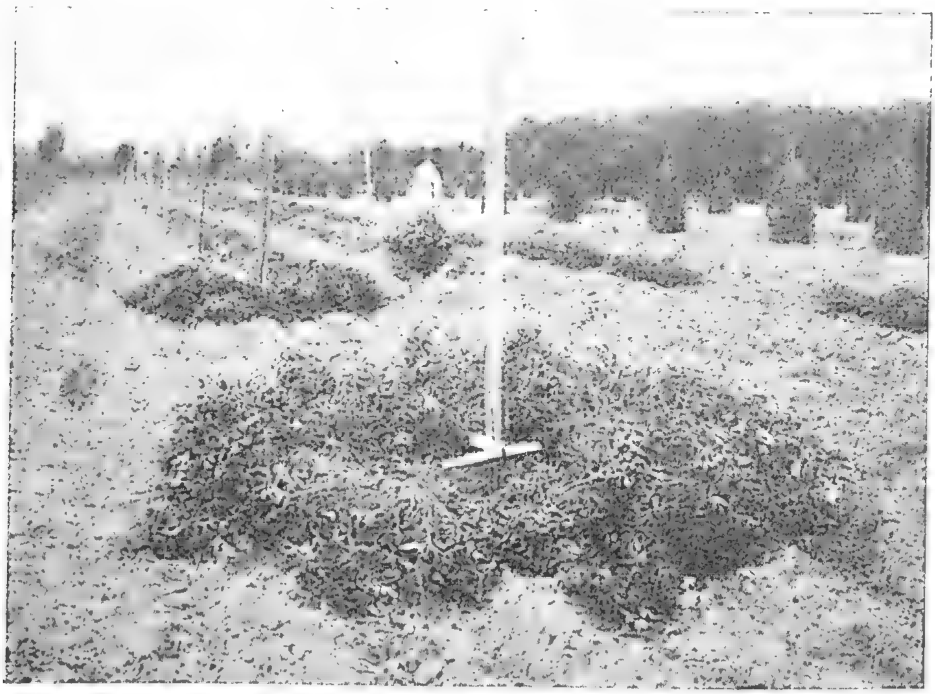

Plate 37.
Poles around which stacks of peanut vines are to be built.

Curing.

After the plants are lifted and the soil shaken from the nuts they are allowed to lie either spread on the ground or in small bunches until the leaves are wilted, but not curled or brittle. They are then bound in small sheaves or taken separately and stacked until cured. The time in which the plants are allowed to wilt varies according to the weather, and in some cases stacking may be necessary within an hour of lifting.

The usual method of curing peanuts where the quantity is large is to place them in small stacks around a pole. From twenty to thirty poles will be required for an acre.

These poles should be reasonably stout, from 2 to 3 inches of hardwood in diameter at the bottom end, which should be sharpened. When erecting, holes are made in the soil with a crowbar, post-hole digger, or

earth auger, and the pole inserted or driven down with a mall to a depth that will ensure their not being blown over with the weight of the stack upon them. Crosspieces about 3 feet in length are now nailed across the post at right angles, one immediately above the other, 9 to 10 inches above the level of the ground; 3 by 1-inch hardwood battens answer the purpose admirably. According to the crop, six or seven rows are taken on each side of the poles, and the plants, when wilted, forked into one row on either side of the pole. When stacking, a few vines are placed across the crosspieces, which keep them off the ground, to form the foundation. The vines are then stacked by hand with the nuts next to the pole and tops outward, pressing down each layer and building evenly around the pole. From time to time a bunch should be divided and hung around the pole to bind the mass and to assist in keeping the centre high.

This latter is important in that it allows any rain falling to run off. When the stack is approaching 3 feet high the vines should be drawn closer round the top and finished off with a cap of grass as a thatch to run rain off. It is important that free circulation of air should obtain through the stack in order to facilitate curing. The building of thick or high stacks or pressing them too tight will tend to cause heating, with consequent damage to both fodder and nuts.

After about two weeks in the stack the peanuts may be stored in the barn, but the nuts should not be picked from the vines until preferably six weeks from the date of harvesting, as if picked too soon they are liable to shrivel, and there is danger of fermenting or moulding after picking.

PLATE 38.
Showing method used in building stacks round the poles. Completed stacks in background.

Picking.

The usual practice formerly was to pick the nuts from the cured plants by hand—a tedious process, the cost of which, if the ruling rate of wages were paid, would be prohibitive, since 60 lb. is considered a fair day's work. This practice of hand picking has been followed for ages, and is still the usual method adopted in countries such as India, China, Japan, &c., where labour is plentiful and cheap. In certain cases, too, the nuts are washed by agitation in frequently changed water and dried in the sun to obtain a clean inviting article for edible purposes. This is necessarily a costly undertaking, and would need a much higher price for washed nuts to compensate.

Other methods adopted in Queensland with a lessening of expense have been, in the case of the bunch nuts, to hold the stems in the hand and thresh the nuts off by beating across tightly-drawn wires or the edge of a board placed midway across a box or other receptacle to hold the nuts, and with both bunch and creeper to rub the whole plant over a wire-netting drawn tight until the nuts fall through. Subsequent winnowings remove trash and light pods, and it is stated thoroughly drying the resultant nuts in the sun will cause the stems or tails to break off in the bags, resulting in a clean sample when it reaches the market.

Plate 39.—Peanut Picker at Work.

In recent years, however, labour and time saving machinery has been evolved which does very satisfactory work in picking, stemming, cleaning, grading, and bagging for market, without breaking or damaging any appreciable quantity of the pods.

Two types of pickers are on the market—one working on the principle of a cylinder grain-thresher and another in which the plants are drawn between spring points over a wire mesh in such a manner that the nuts are pulled off and fall through on to a conveyor, which carries them

through a winnowing process to a stemming apparatus, after which they go through a further winnowing and a cleaning and grading process.

The cost of machines of this description is too great for the individual in most cases, and it would be advantageous, where any considerable collective area was under crop, for farmers to co-operate in a purchase, when the machine, which is on wheels, could be transported from farm to farm.

Contract picking of peanuts should prove economical and effective as the picking crew, working day after day, naturally become expert; so that a greater average quantity is handled daily with less damage than when novices or hands out of practice are engaged.

When a power-driven picker is in use, it is advantageous to place it in a central position in the field where the poles with the stacked peanuts can be transported bodily to the machine, resulting in less handling. With suitable uprights with a cross bar attached to the dray a lever with a grip attached to the top of the pole and passed over the cross bar would use it as a fulcrum, when the long end of the lever being lowered to the shaft would lift the pole entirely clear of the ground, allowing of its quick and easy transport to the picker.

The stems or vines of the plant, after the nuts are detached by the picker, can be stacked, baled, or chaffed and used for forage purposes, while the "dud" nuts (small or immature) can be fed to stock.

Marketing.

Where more than one variety is grown it is important when marketing that each should be kept distinct. Peanuts are usually bagged whole for sale; in this condition care should be exercised to see that the shells are quite dry, as clean as possible, and free from immature nuts and foreign matter.

In localities where freights are high, it is sometimes more remunerative to grow suitable varieties for shelling and to market in that condition.

Special machinery is available to shell peanuts with a minimum of damage to the berries. Bruising of the product at shelling or during transport is injurious as decomposition is liable to set in and rancidity occur. Shelled kernels should also be absolutely dry before packing for the same reason.

Peanut Pool.

Legislation provides for the marketing, within Queensland, of all peanuts through the Peanut Pool Board, the headquarters of which is at Kingaroy.

Full information in connection therewith can be obtained by application to the manager or secretary at that centre.

The Board is generally a source of seed supply.

Pests.

Insect pests are of infrequent occurrence, so far the only attack noticed being occasional instances of mealy bugs on odd roots.

Vermin are very partial to the nuts, as are many birds outside those domesticated.

Disease.

The peanut is seldom subject to disease when grown under suitable conditions of climate, soil, and drainage. That most commonly noted is a form of leafspot (*Cercospora* sp.) which appears as brownish spots on the leaves, and is most frequent in crops maturing towards winter, and especially on sour or poorly drained land.

Others that are occasionally seen are possibly *Sclerotium rolfsii,* and a species of *Rhizoctonia,* which attacks the plant at the collar or that part of the stem at the point of its emergence from the soil. This is denoted by a cobwebby appearance due to the spread of mycelial threads, together with minute round white or brown bodies the size of mustard seeds which are the spore cases of the fungus. The effect on the plant is to stunt the growth where it is not killed outright. The affection, however, is seldom sufficiently serious to materially affect yields.

Yield.

The yield of the peanut crop will, of course, depend on the fertility of the soil, amount of rainfall, and cultural attention bestowed.

While it will bear a satisfactory crop under a small rainfall, showing to an extent that it is drought-resisting, it is not injured by excessive rains provided the soil is well drained. An instance of this was observed at Banyan in 1921, where a perfect sample of the Red Cross variety was seen which had experienced a fall of 120 inches of rain in the growing period.

Crops on a small scale have been estimated to produce 3 tons to the acre, and in the North field crops averaging 1 ton and over are not uncommon; but as a general rule, in satisfactory soils and under ordinary conditions with proper cultivation, 15 cwt. per acre might be expected as a fair average yield.

On many of the poor sandy soils which are recommended for bright tobacco, however, much lower yields, even with fertilizers, can be expected until the humus content is greatly increased by the ploughing under of suitable growing crops or otherwise.

Varieties.

As with most cultivated crops the number of varieties is not inconsiderable; their nomenclature, however, is somewhat varied according to the country in which they are grown. A variety in one country is often identical with that listed under a different name in another.

Varieties fall naturally into two groups—viz., the bunch or upright growers which produce the nuts around the base of the plant, and the creeping or procumbent kinds which produce the nuts along the stems for a considerable distance from the base. These again are divided into kinds which produce large and small nuts respectively.

The creeper varieties usually return a greater yield per acre, but the increased expense in harvesting is calculated to more than offset the somewhat lower average yield of those of upright growth.

The following varieties are most commonly grown:—

Red Spanish also Red Cross.—A strong upright grower with abundant foliage; small, well filled pods clustered about the base of the

plant; yields well and probably gives a lower proportion of shell to peas than other kinds. Peas are bright red in colour and of medium size with a high oil content. Favoured for shelling.

White Spanish.—A small podded variety with upright stems and heavy foliage; pods are thin, usually well filled and are clustered about the base of the plant. Peas are pale brown in colour and rich in oil. Perhaps the most early-maturing variety grown. Suitable for shelling.

Improved Spanish.—This variety has probably been developed by careful selection from the White Spanish which it resembles, except that the stems are stronger and not so upright. The chief difference, however, lies in the pods, which are much larger. Suitable for shelling.

Virginia Bunch.—A large-podded variety; stems upright, not as high as White Spanish and with less foliage. Pods are clustered about the base of the plant and contain usually two and sometimes three light-brown peas of good size. Pods are usually bright and clean, and the variety yields well. Recommended for sale as whole nuts.

PLATE 40.—VIRGINIA BUNCH.

Valencia Bunch.—A small-podded variety with heavy foliage and upright stems. Pods are usually long, containing three or four small peas, sometimes more; peas are dull red in colour. The variety yields well, but the pods do not adhere so well in digging as with the previous-named varieties. Only suitable for shelling, as the pods are apt to burst during the roasting process.

The foregoing are all of bunch and upright growth, the Virginia Bunch being grown most largely for the whole-nut trade and the Red Spanish for sale as shelled for manufacture.

Chinese.—A large-podded variety of strong growth with creeping or prostrate stems and heavy foliage; pods scattered along the procumbent stems do not adhere too well in digging. The pods are much the same size as those of the Virginia Bunch as are the peas within. The variety is probably the same as that called Virginia Runner. The Chinese Runner formerly was largely imported from China, and was chiefly grown in the Cooktown district.

Large Japanese.—A creeping or procumbent variety of perhaps less vigorous growth than the Chinese, but carrying a slightly larger pod. It was considered superior to Chinese in the Cooktown district. Both this and the Chinese are suited for sale as whole nuts.

Mammoth, Jumbo, or Giant.—A creeping variety that yields probably the largest pod of all varieties. The shell, however, is very thick and the proportion of peas to pod lower than in other varieties. The pea is extra large, and on this account is sometimes favoured for particular confections. It is not considered suitable for cropping in this State in competition with more popular varieties.

Rotation.

In order to secure the most profitable return peanuts should be grown in a sequence or rotation with other crops preferably once in every three or four years.

Though the crop, in common with most other legumes, has the power of collecting the free nitrogen from the air and storing it up in small nodules on the roots, its value in this direction is not so great as cowpeas, velvet beans, and other legumes of similar growth, since in harvesting much of the root system of the peanut with adherent nodules is removed from the soil. The amount of nitrogen, however, added to the soil by the peanut crop is considerable and well illustrated in the improved growth of following crops, such as maize or potatoes.

In all crop sequences it is advisable at least once in three or four years to plough under a growing crop to maintain or build up the humus and decaying organic matter in the soil.

Choice of such a crop would be influenced by the volume of growth likely to be made in a short period and the rapidity of its decay or conversion to humus when ploughed under.

Crops such as cowpeas and velvet beans are popular through the amount of nitrogen they add to the soil; but sorghums, teosinte, millets, and especially Sudan grass are generally allowed to provide a greater amount of organic matter during a similar period of growth.

On loamy soils where potatoes, sweet potatoes, and maize would be grown preference would be given to the legume; but on sandy soils, particularly those suited to bright tobacco production in which the humus supply is usually low, preference should be given to the heavier-yielding non-legume.

A suitable sequence of crops is suggested:—

(*a*) For loaming soils—

First year—Legume, to be ploughed under.

Second year—Potatoes, sweet potatoes, maize.

Third year—Peanuts, cotton, broom millet.

(b) For sandy soils—

First year—Non-legume, to be ploughed under.

Second year—Hay or grain crop.

Third year—Peanuts, cotton, broom millet, tobacco.

Uses.

The peanut is a most valuable economic crop and capable of many diversified uses, the chief of which may be summarised:—

The whole plant as a stock food either to be fed off or harvested and stored for use as required;

The plant, exclusive of the nuts, cured as hay, in which it is close to lucerne in food value and fed to stock;

The nuts for edible purposes either as whole nuts or shelled for use in confectionery;

The nuts for oil;

The residue after extracting the oil, in some cases for edible purposes, but mainly for stock food or as manure.

As a rotative crop, also in sequence with tobacco, maize, and other crops, the peanut is commended.

Hay.

Whether the whole crop, especially the bunch or upright growing varieties, is harvested and stored as hay with or without the adhering pods the product forms a valuable stock food. The greatest economy, of course, lies in marketing the nuts and using the balance as hay, but where through a high cost of freight this is not practicable the added food value of the nuts is considerable.

As noted previously in this article, the harvesting of the crop should be regarded as a haymaking of the tops. As with lucerne the loss of the leaves in harvest results in a considerable reduction in fodder value as well as in weight. Care consequently should be exercised to prevent undue loss in this direction.

There is probably no better or more economical system of harvesting than the pole stacking previously described, the advantages of which should be obvious. The stack round the poll allows a free circulation of air below and through the curing mass; the curing is gradual with a full retention of the leaves, which retain their green colour, except round the edges of the stack where exposed to dew and direct sunshine.

There is less handling, as, when cured, the poles, each with its burden, can be lifted and transported to the picker, after which the hay can be stacked or baled ready for home feeding or sale.

The following analyses* comparing the fodder values of peanuts and lucerne are informative:—

—	Total Dry Matter.	Digestible Nutrients in 100 Lb.				Nutritive Ratio.
		Crude Protein.	Carbo-hydrates.	Fat.	Total.	
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
Lucerne	91·4	10·5	39·0	0·9	51·6	1 : 3·9
Peanut vine	78·5	6·6	37·0	3·0	50·4	1 : 6·6
Peanut vine with nuts ..	92·2	9·6	39·6	8·3	67·9	1 : 6·1

In palatability, probably peanut hay is ahead of lucerne, as stock greedily eat the hard sun-dried stems, no matter how long exposed.

In feeding the hay or the whole cured plant to horses and cattle, the receptacle should allow of any soil adhering to the roots falling through; the danger in feeding mouldy peanut hay is the same as with mouldy hay of any other kind.

Feeding-off.

On farms where pigs are raised it is usual to turn the animals into the field to harvest such nuts as may be left on removal of the crop. This is especially desirable when creeping or running varieties are grown.

Occasionally also, where the bunch varieties are grown, the tops are mown, cured into hay, and removed prior to turning the pigs in to harvest the remainder. This would appear preferable to feeding off the whole crop as, though the animals would consume a certain amount of the vines, a greater quantity would be soiled and destroyed.

There is a prejudice against pigs fattened on peanuts, since the pork is soft and shrinks more in curing processes than when maize or other concentrates are fed; the lard, too, from peanut-fattened pigs is undesirably soft and oily.

These defects, it may be noted, appear in pigs fattened exclusively on peanuts, but it may be expected that when young animals are grown thereon and topped off with other foods known to produce firm flesh the difficulty would be obviated.

Manufactures.

In addition to the treatment of the shelled and unshelled peas for human consumption, there are numerous products as oils, butters, flours, meals, breakfast foods, relishes, sauces, confectionery, &c., manufactured wholly or partly therefrom.

Oil.

The chief value of the peanut is as a source of oil known to the trade as China oil.

The shelled peas of the large nuts, such as Virginia Bunch and Chinese Runner, contain an average of about 43 per cent., while the smaller nuts of the Spanish Bunch varieties, particularly the Red Spanish, frequently yield 52 per cent. of oil.

* Henry and Morrison in "Feeds and Feeding."

Amongst the uses of the oil are:—Finest oil as salad oil and for use in medicine, the arts, and as a lubricant for high-speed journals in delicate machinery, &c.; first quality grade for cooking and in the manufacture of margarine; also as a lubricant and harness dressing, &c.; lowest quality grades for soap-making and other industrial purposes.

The extraction of the oil is a simple process and entails less procedure and machinery than other oil-yielders. The bulk of the oil is obtained by simple pressure, and the balance recoverable on heating and again subjecting to pressure.

Oilcake or Meal.

Where particular attention is paid to the skinning and degerming of the peas before the oil is expressed, the resultant cake or meal is used in the preparation of human foods; otherwise, the cake is used for stock food and as manure.

Average analyses of peanut oil cake show, according to Henry and Morrison:—

—	Total Dry Matter in 100 Lb.	Digestible Nutrients in 100 Lb.				Nutritive Ratio.
		Crude Protein.	Carbo-hydrates.	Fat.	Total.	
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
From whole nuts	94·4	20·2	16·0	10·0	58·7	1 : 1·9
From shelled nuts	89·3	42·8	20·4	7·2	79·4	1 : 0·9

The feed value of these products is at once apparent; and, viewing the richness in protein as evidenced in the nutritive ratio, it becomes most valuable as a concentrate for addition to stock foods in making a balanced ration.

FIELD CROPS.

Speaking recently on crop prospects the Director of Agriculture (Mr. A. E. Gibson) remarked that the lucerne crop had in many instances been spoilt in harvesting by reason of excessive rains, and, no doubt, considerable quantities of hay had been more or less damaged. It was reasonable to believe, however, that from now onwards conditions would be more suitable for both the production and conservation of lucerne in the form of hay, provided the country experienced normal conditions usually associated with this period of the year.

Mr. Gibson advised those farmers who contemplated increasing their lucerne areas to set about the initial preparation as soon as opportunity offered, with the fixed purpose, as far as possible, of eradicating every description of weed. It was imperative that the soil prepared for lucerne should be reduced to as fine a tilth as possible in order to stimulate rapid growth, and at the same time bring about rapid germination. Sowing by means of the drill in this crop was to be recommended, and better results would be achieved if the first half of the seed were sown at right angles to the second half. In this way a better planting was brought about, and the quantity of lucerne seed used could be reduced by at least 25 per cent., compared with the more common method of sowing.

Those who intended planting winter cereals were advised that fallowing operations should now be well under way, particularly in the case of the wheat areas. Any action that could be taken, which was calculated to bring about rapid germination of volunteer crops, such as oats and barley, should be given attention to, as considerable trouble already had been experienced in the wheat-growing areas from this source. The loss in quality of the grain, caused by foreign growth, was considerable.

The Housing of Poultry.

By P. RUMBALL, Poultry Expert.

A SURVEY of many farms indicates that one of the principal causes of impaired health and high mortality is due to inadequate housing. It is not the case only that the housing accommodation is too small, but that it is of the wrong design, and does not lend itself to the easy maintenance of those sanitary conditions necessary to health and vigour. Elaborate and costly houses are not necessary, but they should be of sufficient size for easy access, and the floors should be as impervious as possible, such as concrete, so as to permit of thorough cleaning at definite periods. Buildings are generally erected for a definite number of birds, but it is found that, as the flock increases, the tendency is to use these buildings for greater numbers than for which they were originally designed. This evil is not only noticed with reference to the accommodation of adult stock—where the least harm is caused—but it is more pronounced in the accommodation used for the rearing of young chickens and growing stock.

The success of a poultry raiser is dependent firstly upon the number of chickens that are reared to maturity, and, as overcrowding is one of the principal causes of mortality amongst chickens, the consequence of insufficient accommodation becomes more serious as a poultryman extends his business. It has also to be borne in mind that the loss through overcrowding does not end in the death of chickens. Others may survive improper treatment, but their health and vigour are so impaired that their potential egg yield is greatly decreased.

Systems of Housing.

There are three practices commonly adopted, viz.:—

(1) Intensive, where the birds are kept entirely under cover;

(2) Free range, where a house is erected to provide sleeping accommodation, and unrestricted liberty permitted; and

(3) House and yard, where a house is provided for sleeping quarters, and liberty is restricted by the erection of a run.

Under the intensive system, the birds are kept entirely under cover, and are thereby afforded the maximum protection from climatic conditions, ensuring greater stability in production. The health and condition of the birds are readily observed by the farmer. Further, it is possible to thoroughly free the house from excreta at regular intervals.

Under the free range conditions, some contamination from excreta of the stock naturally takes place, but, owing to the unrestricted range and the feeding on the soil by plant life, soil contamination does not become serious. The birds are, however, exposed to climatic variations, and the egg yield is not as stable as under the intensive system. There is, however, the compensation in the reduced cost of feeding, as birds obtain a good deal of their natural food supply by foraging.

The yard and house system has the disadvantages and none of the advantages of both the intensive and free range systems. The addition of the yard adds to the cost of accommodation. The birds are exposed to climatic conditions as much as they are under the free range system.

Egg production is not stable, nor are the birds in a position to gather any of their own food requirements. The most serious disadvantage, however, of this system is soil contamination. A good many of the highly contagious diseases of poultry, and internal parasites, are transmitted from bird to bird through the excreta. Many organisms of the common diseases of the fowl will lie dormant in the soil ready to cause infection on the first favourable opportunity. Although the excreta may be scraped regularly from the surface of the poultry yard, many of the minute organisms and worm eggs are below the surface, and it is only necessary for favourable conditions to arise before infection takes place.

When the house and yard system is adopted, two yards should be erected for each house. This enables one yard to be spelled, planted with some crop suitable for green feed, and the soil thus sweetened.

For the specialist poultry keeper, where large numbers of laying stock are to be kept, the intensive system of housing is most suitable. For the farmer who raises poultry as an adjunct to other rural pursuits, the free range system offers many advantages.

Care of Growing Stock.

In the housing of growing stock the pens are only occupied throughout six months of the year, and as egg production does not enter into consideration, the exposure to climatic conditions is not so material. Likewise, soil contamination is not pronounced. To obtain the maximum development, exercise must be provided. The free range system answers admirably for the purpose of the development of growing stock, but as several hundred pullets of different ages have to be reared, it is necessary to erect netting fences for the separation of the various lots. These runs should be made as large as the land will permit, allowing not less than 6 square yards per bird, and the number in any one pen should not exceed one hundred.

Brooding of Chickens.

There are numerous systems of brooding chickens. The system to be adopted depends largely upon the number to be handled, the personal inclinations of the farmer, and the capital to be expended. The subject of brooding is too extensive for full reference in this article.

Intensive Housing System.

Under this system of housing, as previously mentioned, the birds are kept entirely under cover in fairly large sheds, and in relatively large numbers. This being so, strict attention has to be paid to the physical condition of the bird, and to the question of feeding. As the bird only has a very restricted space, 4 square feet per bird being about the correct area, exercise has to be promoted to ensure the birds being kept in good condition. This is done by having scratching material or litter, such as grass, straw, leaves, or chips strewn over the floor, to the depth of 4 to 6 inches, and all the grain portion of the ration being fed in it. This naturally promotes a good deal of scratching on the part of the bird in search of grains that have become covered, and it should be patent to all poultry raisers that the feeding of the evening grain should not be left until the day is drawing to a close. Many farmers are in the habit of allowing a good deal of range to their birds, with the consequence that they gather a fair amount of natural food, and naturally

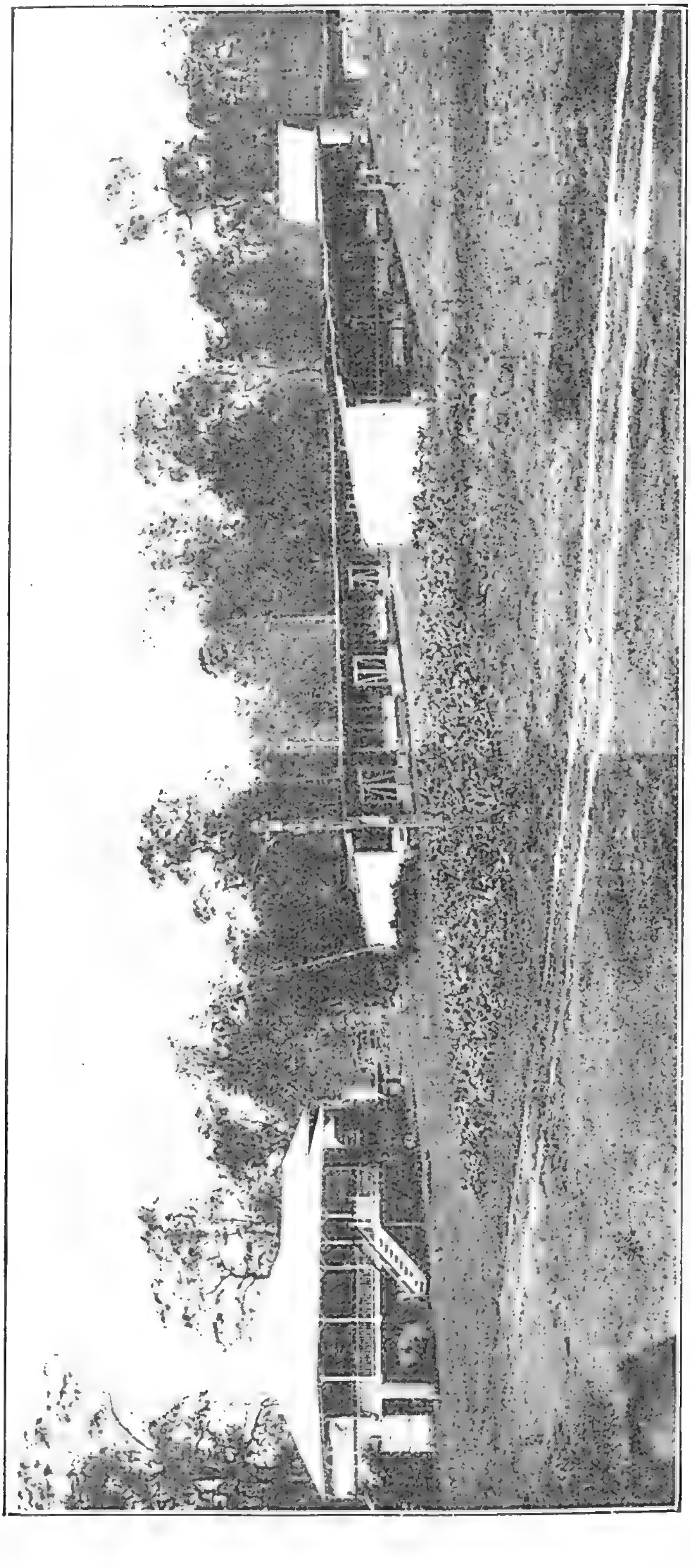

PLATE 41.—ON A QUEENSLAND POULTRY FARM. THE INTENSIVE SYSTEM ADOPTED WHOLLY FOR LAYING STOCK.

Housing under the intensive system allows 3½ to 4 square feet of floor space for each bird: under the free-range system 2 square feet are sufficient.

do not consume as much as birds kept entirely under cover. If at any time poultry breeders keeping birds under such conditions think it desirable, on account of the damage done by their poultry to crops, hay-stacks, &c., to change over to the intensive system, the question of feeding assumes a most important point; in fact, any person keeping poultry under these conditions must give the question of feeding the utmost consideration, as it is impossible for the birds to procure anything but what they are supplied with. The overlooking of this point by many poultry farmers has caused this system of housing to be condemned.

This system of housing poultry enables a greater number of birds to be kept on a given area than any other. It permits of birds being handled in large units, and therefore not only reduces the natural labour but goes a long way in reducing the cost of production, which is a big feature, especially in times of high-priced foods. It is also much easier to detect sick and unproductive birds in an area of, say, 400 square feet than is the case when large runs are used, and therefore the early disposal of these, a practice highly desirable, is facilitated. With this system also there is generally greater attention given to the questions of the construction of the houses and the numbers housed in a shed of certain dimensions. Both these questions play a very important part in the question of disease, and the development of stock. It is not uncommon to notice a house built to house at night fifty laying hens having sixty-five birds in it. To do this, possibly the perches have been placed closer together, and when it is suggested to the breeder that he is overcrowding, he states that they only sleep in the shed and he lets them out on free range during the day. Although it must be admitted that stock on free range will possibly put up with much severer conditions than those kept in pens, it is maintained that it does not matter how good the conditions are during the day, they will not overcome the ill-effects of overcrowding during the night. With the intensive system of housing, overcrowding is not noticed to the same extent; the breeder knows how many birds the shed was built for, and there is no point that can be raised in favour of going beyond this number.

Types of Intensive Laying Sheds.

There are several types of laying sheds, the shape of the roof being the principal point, but as the majority of poultry raisers have to do the erection of their own sheds, the lean-to type will prove most acceptable. The illustration shows the cross section of a shed, 20 feet deep, and of indefinite length. This shed can be built in sections of 20 feet, and provision made for additions as required, each section holding 100 laying hens.

The cross section shows a veranda, which commences just under the rafters in front. This veranda serves to prevent a good deal of rain beating into the house from the front, and by not going right to the top of the roof allows a free circulation of air. If it is desired the roof could be extended by 3 feet and the veranda not used, but in that case the height of the shed in front could be a little bit less. Ventilation is also provided for at the back, the iron going from the floor level to the bottom of the 6-inch rafter. This allows a 6-inch space right along the back of the shed between the battens which carry the iron at the back and the roof. This space is protected to some extent from the driving influence

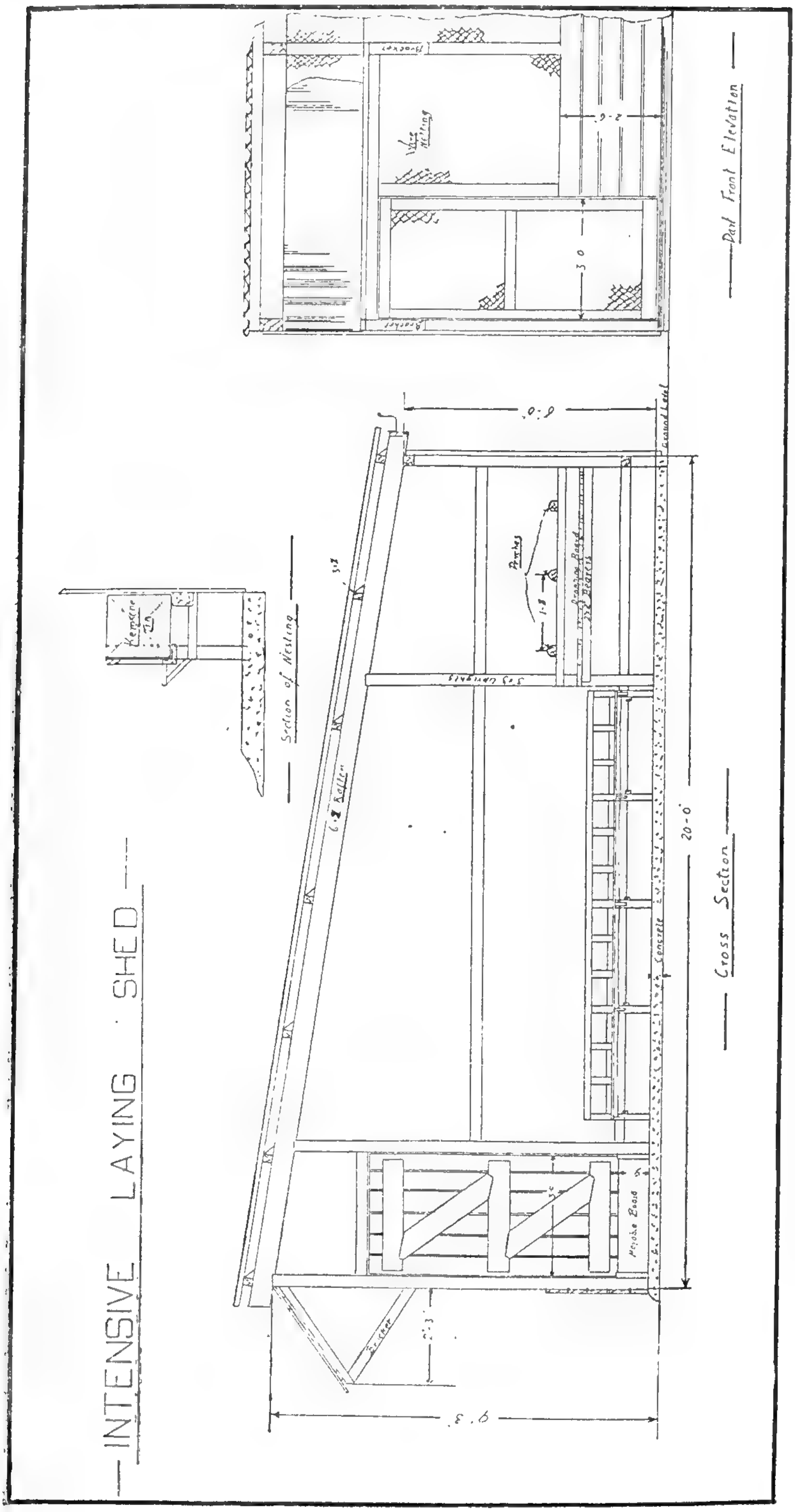

PLATE 42.—SHOWING END SECTION AND PART FRONT ELEVATION OF INTENSIVE LAYING SHED.
End section, with the exception of door and battens to carry the iron, should be erected every 10 feet in a shed of these dimensions.

of the wind by guttering being placed on the rafters, which extend beyond the back wall, but further protection for the birds from cats, &c., should be made by netting this space.

Materials.—The shed should be built with good, sound hardwood posts, although where desired solid, sapped bush timber could be used for uprights, but the average builder would find sawn timber easier to handle. All other frame work should be sawn timber, that coming in contact with the ground hardwoods, and the balance pine. The dimensions of the timber are shown in the cross section, and as the building is of goodly dimensions, it would not be advisable, on the plea of economy, to use lighter material. The walls and roof should be of iron, and also the wind break in front, although timber, if cheaper, could be used.

The Site.

Site of House.—In commencing to erect a building upon the intensive system, it being a large building and of a permanent nature, the site chosen must receive due consideration, and, as many poultry raisers start in a small way, provision should be made for extensions.

In addition to the foregoing, although it is recommended to concrete the floor, the position chosen should be well drained, and, if the building is to be erected on relatively flat country, the floor should be raised several inches above the surrounding country, and well rammed to provide a solid foundation.

Aspect.—The house should face north or north-east. A northerly aspect permits of the maximum penetration of the sun's rays into the house during the winter, when it is desirable, and the minimum during summer; also a good deal of our continuous rains come from a south-easterly direction.

The Layout.

General Fittings.—In the cross section a door constructed of timber is shown, while the front elevation shows another of netting. Although this shed is built for the purpose of keeping the birds entirely under cover, it frequently is desirable to let the birds out into small runs during cleaning operations, or it may be that, in a long section, it is desirable to go into a pen direct. This is only possible when front doors are provided. The door in the end section permits a person feeding, &c., going from pen to pen direct, and, for the small cost in labour and material, both doors should be provided when the building is first constructed.

The perches, three in number, are placed along the back of the shed extending the full length. Under the perches is a dropping board. The advisability of this or otherwise is left to the individual breeder. If it is not to be cleaned daily, it should not be provided, but for the breeder who uses it there is a ready market for pure poultry manure, while, at the same time, he keeps his litter clean for a longer period. Another system by which the droppings may be kept from mixing with the scratching material is by placing timber, say, 6 inches in front of the front perch the full length of the building. This timber would need to be at least 18 inches high, and it may be as well to cover the whole area with netting to prevent the birds from getting in among the droppings. This pit, however, would need to be cleared out fairly frequently to prevent offensive odours, as there would be nothing to absorb any moisture. With the

dropping board the birds have the full floor to scratch over, but a sharp lookout must be kept for red mite, as it provides additional harbour for them.

The nests are shown supported on a framework on the side of the building. These are kerosene tins on their sides. Two-thirds of each side is cut out. This provides a top which assists in keeping clean nests, and by both sides being cut the excessive heat is reduced. These should be placed at the coolest end of the building. Even although nests are provided many birds will persist in laying under them or in some old corner. If this is the case, the nests could be placed on the ground, as it is as well to induce the birds to make use of them to keep the eggs as clean as possible. Drinking and feeding receptacles are left to the breeder's own device. Some may be able to make use of some form of automatic water system, others may have to depend upon the kerosene tins. Some breeders may use dry mash hoppers, while others feed a wet mash. The principal feature is to provide ample water and sufficient feeding space for your stock. It is better to overdo both these features than to economise in this direction.

FAT-LAMB PRODUCTION—LESSONS FROM NEW ZEALAND.

Pasture improvement as a means to adequate feeding was an essential factor in profitable fat-lamb production, pointed out the Agrostologist of the New South Wales Department of Agriculture in a recent wireless address. In New Zealand, said the speaker, he had been impressed by the provision made for the supply of succulent pasturage on the numerous farms where the production of prime sucker lambs was aimed at.

In that country good sheep management, feeding, and breeding had gone hand in hand. The New Zealand lamb raiser had realised many years ago that in order to produce a quicker-maturing, prime quality lamb, grading up of the pastures was absolutely essential, as early-maturing stock, whether beef or mutton producers, required an abundance of palatable, nutritious feed.

The main reasons why New Zealand could produce and maintain a supply of sucker lambs suitable for the export trade were:—

(1) The excellent pastures available, also climatic conditions which were conducive to the optimum growth of nutritious English grasses and clovers.

(2) The utilisation only of sheep of the highest quality in the production of export lambs.

As New Zealand practically depended on grass-land farming to provide all the feed required for sheep and cattle, it was only to be expected that every farmer had the grass-land "sense" particularly well developed. In New Zealand 16,000,000 acres of land had been planted with seed of succulent pasture plants such as perennial rye, cocksfoot, perennial red and white clovers, and 300,000 tons of artificial fertilizers were applied to grass-land areas annually. The New Zealand farmer appreciated the value of his pastures, and all his efforts were centred on maintaining a high state of soil fertility.

When the soil fertility of any area decreased, it was inevitable that the plants associated with a high standard of fertility would diminish in quantity and ultimately disappear from the pasture, poorer quality pasturage and weeds taking their place. Good quality stock and particularly fat lambs and baby beef could not be raised on poor quality grass-land areas.

Agricultural Notes.

By H. S. HUNTER, Agricultural Branch.

SEASONAL PROSPECTS.

THE advent of hot weather after the wet conditions of December has stimulated the growth of vegetation and facilitated completion of the wheat harvest. It has been favourable also for haymaking, and full advantage has been taken of it in the principal lucerne-growing areas, where the crops had made excellent growth. The markets have been heavily supplied with lucerne chaff and lucerne hay, both of which lines have been selling freely at low values. Many of the offerings in the earlier part of the month were of indifferent quality, due to inclement weather at the time they were cured.

Potatoes also have been arriving in large quantities, with, as a result, unattractive prices to the grower, but in many instances the return was unnecessarily low owing to faulty grading and bagging. Uniform grading of most lines of farm produce, particularly potatoes, is essential if the consignment is to be disposed of to the best advantage.

Wheat.

From reports to hand at the time of writing, the deliveries to the Pool are estimated to represent about half of the current season's crop. Late deliveries will be unavoidable this year owing to the fact that weather conditions have interfered, not only with harvesting operations, but also with the transporting of the grain to the receiving depots.

The same set of conditions has delayed the initial working of the fallows of the proposed wheat areas for the 1934-35 season. Early and thorough preparation of the land is an important factor in successful wheatgrowing under Queensland conditions. It places the land in receptive condition for the trapping of moisture from the late summer rains, and facilitates the early germination of any grain and weed seeds which may be present in the soil. The present season has favoured volunteer growths, the early eradication of which is desirable.

Canary Seed.

The harvesting of this crop also has been delayed by weather conditions. Clean land is more essential, perhaps, for canary seed than for the other cereals.

One of the causes of excessive expenditure in connection with the Canary Seed Board's operations is the necessity for cleaning the seed to fit it as a merchantable product which would conform to pure seed regulations existing in this and other States of the Commonwealth. This has necessitated, in some instances, the cleaning of consignments three and four times. The cost of the first cleaning is a pool charge, but all subsequent cleanings are individual charges against the consignment concerned. It therefore is in the interests of canary seed growers to produce grain free from foreign seeds. The crop should be grown on land which is as far as possible free from volunteer growths of winter cereals and weeds.

Two weeds which give a considerable amount of trouble are fat hen (*Chenapodium*) and convolvulus (*Polygonum vulgare*). Incidentally, consignments have been received containing *Datura* or thorn apple, sometimes known as oil plant, and such are held up for cleaning before any

advance payment is made. The *Datura* plant is easily distinguishable and, therefore, roguing from the crop during harvesting operations is facilitated.

Cotton.

Some abandonment of crops has been caused by more or less excessive wet conditions, especially in the Central district. It is believed, however, that at least 70,000 acres are under cotton with prospects of producing profitable yields.

Reports from all centres indicate that although the season has been fairly wet to date, no excessively rank development of the plant has occurred, the majority of the crops having plants of a nice type, and carrying a good crop of flower buds and young bolls, with the most advanced crops bearing several well-developed bolls.

Good rains will be required in the near future in order to develop the crop which is now setting, and given these it is anticipated that many heavy yields will be obtained in all districts.

Insect attacks have been very light so far, the main trouble being mostly terminal loss caused in the earliest planted crops by the rough boll worm and to some extent by the tip-boring worm.

The season has demonstrated the value of cultivating as soon as the rows of young seedlings are discerned. Where this has been done even the growers with large acreages have well-cultivated fields, but where it has been neglected the continuous showery conditions produced such a rank growth of pig weed and summer grass that the later cultivations could be made only with great difficulty, and in extreme cases a portion of the individual acreage has had to be abandoned.

Dairying.

The output of dairy products is exceptionally heavy in all districts, and in some instances the factories are experiencing difficulty in coping with the quantities of cream coming forward. Australian butter reached its lowest level in London last month, when it was quoted at 63s. per cwt. Unfortunately, the local price has been influenced accordingly. The lot of the dairyman should be improved to some extent when the stabilising legislation, recently passed by the Commonwealth and the States, becomes operative.

Another step in this direction was taken in Sydney last month, when an interstate conference of dairy industry representatives agreed on proposals for the regulations which are to be set up under the Commonwealth Act.

Fruit.

The deciduous fruit season has been marked by low values owing to the size of the crop and the high proportion of fruit affected by excessively wet weather. An excellent yield of apples is in prospect, but marketing difficulties are anticipated unless the local market can be relieved by increased export. Last season witnessed an increase in production of approximately 100,000 cases, and a further progressive increase is expected this year.

Banana and pineapple plantations benefited by the wet conditions, but weeds have caused considerable trouble, necessitating the use of sprays. Permits have been issued covering the planting of over 4,000,000 banana suckers, the heaviest plantings having taken place in the Currumbin area. Growers in all areas, including the North Coast, have been warned of the necessity of vigilance for the early detection of bunchy top infestation.

Maize Varieties for the Lockyer Valley.

A report of the trials conducted at the Queensland Agricultural High School and College, Gatton, during the seasons 1925-26 to 1932-33 inclusive, by J. R. A. McMillan, M.Sc. (Cornell), Senior Plant Geneticist, Division of Plant Industry, C.S.I.R., and W. W. Bryan, B.Sc. Agr. (Queensland), Instructor in Plant Breeding, Q.A.H.S. and C.

IN view of the importance of maize-growing in the Lockyer Valley of Queensland, it was thought desirable to conduct experiments to determine the most suitable variety or varieties for the district. To this end work was commenced at the Queensland Agricultural High School and College in the year 1925-26, and is still in progress. It was felt, however, that as some definite results have been obtained, they should be made available to growers.

The maize is grown under conditions approaching, as far as possible, those which would be adopted by progressive farmers in the district, although certain modifications had of necessity to be adopted since the work is experimental. In the Lockyer Valley it is usual to grow maize on the same land for two or three years in succession, hence it was decided to conduct the trials on land in its second season under maize.

The site chosen is changed annually in accordance with the College farm rotation, but the soils throughout are fairly uniform, being heavy black soils with calcareous nodules forming a sub-surface layer—a Tshernosemic phase. Fertilizers are not used since previous experiments have not shown any beneficial response to them.

The average annual rainfall for the district is between 27 and 28 inches, but the majority of this falls during the maize-growing season. The actual amounts for the growing season are given with the results each year (see below).

Varieties Used and Sources of Seed.

It was decided to include in the trial some of the most promising varieties used in Queensland and New South Wales which would be likely to succeed under the conditions. Seed of these varieties was obtained originally from the State Departments of Agriculture. In order to ensure uniformity of strain within the variety, subsequent seed was and is being obtained annually from a State Department of Agriculture when possible. Otherwise it is produced at the College under isolated conditions in order to prevent cross breeding. The following varieties are obtained regularly, or were obtained until discarded, from the sources stated:—Golden Beauty, Funk's Yellow Dent, Improved Yellow Dent, and Red Hogan from the Department of Agriculture and Stock, Queensland; Fitzroy, Giant White, Golden Beauty, Golden Nugget, Golden Superb, Hickory King, Kennedy, Leaming, Manning Silvermine, and Yellow Hogan from the Department of Agriculture, New South Wales. Red Nib is obtained annually from the same seedsman. For comparison with the abovementioned varieties, seed is selected

from College-grown crops of Fitzroy, Improved Yellow Dent, and Red Hogan. Thus, in all, seventeen varieties have been tested, some of which have been discarded when proved unsuitable.

Methods.

The land is prepared in the usual manner sometime before it is required. At planting time drills 4 to 5 inches deep and 4 feet 6 inches apart are opened with a specially-made double mould-board attached to the tines of a cultivator. A wire, with tapes tied at intervals of 3 feet to act as markers, is stretched along the row, and five seeds are sown at each marker. The wire is removed and the drill closed by means of a single-row scuffler or harrows, the seeds being covered to a depth of about 2 inches. After germination the hills are thinned down to a uniform stand of three plants per hill. The plants removed from each hill are taken at random—they are not selected. The crop is cultivated in a normal manner such as would be done by the better farmers in the district, with the possible exception that a little more chipping is done because of serious infestations of nut grass (*Cyperus rotundus*) in some paddocks.

The arrangement of the plots in the seasons prior to 1928-29 was of the systematic checker-board type with check plots every third. Since then Fisher's methods of randomised arrangements have been used, either as a latin square or randomised blocks. The number of plots of each variety varies from six to ten. Unpublished data from College Uniformity Trials suggest the use of a plot eight to ten rows wide and one chain long as being the most efficient. The plots in the trial, therefore, are ten rows wide and one chain long, and are thus about one-fourteenth of an acre in area. Between the ends of plots a lane 6 feet wide is left, but no space is left at the side of plots. To eliminate border effect at the sides of the field, two guard rows are sown on each side.

Not all of each plot is harvested for experiment purposes. The outer row on either side of each plot and the two end hills at each end of each row are discarded in order to eliminate competition and border effect respectively. The remainder of the inner eight rows of each plot are harvested and bagged separately. The area of this portion of the plot is about one-twenty-second of an acre. Later the ears are shelled, the grain weighed, and a representative 2-lb. sample is taken from the produce of each plot by means of a stick sampler. This sample is analysed for moisture content in a standard Brown Duvel tester, duplicate tests being made. All weights are then standardised to a uniform basis of 14 per cent. moisture in order to determine the true value of a variety in comparison with others.

Results.

The results of the trials conducted to date are given separately for each season in the accompanying tables. Only mean yields of varieties are given, and all yields are on a basis of 14 per cent. moisture. Individual plot yields are available to workers wishing to use them.

Any variety which is significantly better than another is also better than those lower in the table than the first one exceeded. No differences, other than those shown as such, are significant.

Season 1925-26.

Plan.—Systematic ; two ranges each with every variety included once ; check plot every third.

Plot Size.—Ten rows, 77 yds. long. *Planting Date.*—8th January, 1926.

Rainfall over Growing Period.—5·6 in. (drought year).

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Red Hogan (College) (Check)	21·95	4 *et seq.*
2. Fitzroy (New South Wales)	19·49	7 *et seq.*
3. Improved Yellow Dent (Queensland) ..	19·11	7 *et seq.*
4. Yellow Hogan (New South Wales)	17·05	8 *et seq.*
5. Funk's Yellow Dent (Queensland)	16·42	8 *et seq.*
6. Red Hogan (Queensland)	15·09	9
7. Golden Beauty (Queensland)	14·71	9
8. Golden Beauty (New South Wales)	12·07	..
9. Golden Nugget (New South Wales)	10·38	..

Analysis by means of check plot method, a calculated yield being determined for every plot, thus—Calculated yield of $A = \frac{2C_1 + C_2}{3}$ where the plot order is $C_1\ A\ B\ C_2$, etc.

S.E. single row = 5·44 per cent.

Season 1926-27.

Plan.—Systematic checkerboard ; ten plots of each variety ; check plot every third.

Plot Size.—Ten rows, 1 chain long. *Planting Date.*—30th December, 1926.

Rainfall over Growing Period.—16·74 in.

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Fitzroy (New South Wales)	42·88	6 *et seq.*
2. Improved Yellow Dent (Queensland)	41·33	6 *et seq.*
3. Golden Nugget (New South Wales)	37·17	6 *et seq.*
4. Yellow Hogan (New South Wales)	34·93	6 *et seq.*
5. Golden Beauty (Queensland)	29·60	6 *et seq.*
6. Red Hogan (College) (Check)	28·41	7
7. Golden Beauty (New South Wales)	24·62	..

Analysed by Student's method against check.

Season 1927-28.

Plan.—Systematic checkerboard ; ten plots of each variety ; check plot every third.

Plot Size.—Ten rows, 1 chain long. *Planting Date.*—28th December, 1927.

Rainfall over Growing Period.—24·35 in.

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Fitzroy (New South Wales)	62·81	3 *et seq.*
2. Improved Yellow Dent (Queensland)	60·21	3 *et seq.*
3. Golden Nugget (New South Wales)	49·05	4 *et seq.*
4. Golden Beauty (Queensland)	46·17	7
5. Red Hogan (College) (Check)	45·27	7
6. Yellow Hogan (New South Wales)	44·49	7
7. Golden Beauty (New South Wales)	37·15	..

Analysed by Student's method against check.

Season 1928-29.

Plan.—Nine Randomised Blocks. *Plot Size.*—Nine rows, 1 chain long.

Planting Date.—26th December, 1928. *Rainfall over Growing Period.*—16·74 in.

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Golden Nugget (New South Wales)	63·3	6 *et seq.*
2. Improved Yellow Dent (Queensland)	59·9	10 *et seq.*
3. Improved Yellow Dent (College)	59·4	11 *et seq.*
4. Leaming (New South Wales)	59·2	11 *et seq.*
5. Fitzroy (College)	58·7	11 *et seq.*
6. Fitzroy (New South Wales)	57·9	11 *et seq.*
7. Giant White (New South Wales)	56·4	11 *et seq.*
8. Yellow Hogan (New South Wales)	55·9	12
9. Golden Beauty (Queensland)	55·2	12
10. Hickory King (New South Wales)	54·7	12
11. Manning Silvermine (New South Wales) ..	51·0	12
12. Golden Beauty (New South Wales)	37·3	..

Three blocks were discarded at harvest owing to the passage of storm waters across them. This upset the standard method of analysis, and hence no S.E. for the field was calculated. Significant differences were obtained by direct comparison of one variety with another.

Season 1929-30.

Plan.—Seven Randomised Blocks. *Plot Size.*—Five rows, 1 chain long.

Planting Date.—6th January, 1930. *Rainfall over Growing Period.*—19·17 in.

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Fitzroy (Short)	73·6	6 *et seq.*
2. Fitzroy (New South Wales)	73·57	6 *et seq.*
3. Improved Yellow Dent (Queensland)	67·59	7 *et seq.*
4. Leaming (New South Wales)	67·27	7 *et seq.*
5. Fitzroy (College)	66·98	10 *et seq.*
6. Improved Yellow Dent (College)	62·11	13 *et seq.*
7. Yellow Hogan (New South Wales)	59·92	13 *et seq.*
8. Hickory King (New South Wales)	59·83	13 *et seq.*
9. Golden Beauty (Queensland)	59·59	13 *et seq.*
10. Golden Nugget (New South Wales)	57·27	14
11. Manning Silvermine (New South Wales) ..	56·49	14
12. Giant White (New South Wales)	56·13	14
13. Hickory King (Short)	51·17	..
14. Golden Beauty (New South Wales)	48·26	..

S.E. of a mean treatment yield = 2·54 per cent. or 1·56 bushels per acre.

Differences exceeding 3 × S.E. or 4·67 bushels per acre are significant.

The varieties marked "(Short)" were obtained from Mr. Short, Queen street, Grafton.

Considerable difficulty was experienced in obtaining seed supplies, and on this account only small plots of five rows could be sown.

Season 1930-31.

Plan.—Eight Randomised Blocks. *Plot Size.*—Ten rows, 1 chain long.
Planting Date.—11th January, 1931. *Rainfall over Growing Period.*—15·48 in.

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Leaming (New South Wales)	56·16	5 *et seq.*
2. Improved Yellow Dent (Queensland)	51·00	11 *et seq.*
3. Improved Yellow Dent (College)	50.40	11 *et seq.*
4. Fitzroy (New South Wales)	49·0	12
5. Yellow Hogan (New South Wales)	48·51	12
6. Fitzroy (College)	47·32	..
7. Golden Nugget (New South Wales)	46·28	..
8. Kennedy (New South Wales)	45·23	..
9. Golden Beauty (Queensland)	44·9	..
10. Hickory King (New South Wales)	44·17	..
11. Golden Superb (New South Wales)	43·11	..
12. Giant White (New South Wales)	41·69	..

S.E. of a mean treatment yield is 2·46 bushels per acre.
Differences exceeding 3 × S.E. or 7·39 bushels per acre are significant.

Season 1931-32.

Plan.—Nine Randomised Blocks. *Plot Size.*—Ten rows, 1 chain long.
Planting Date.—8th January, 1932. *Rainfall over Growing Period.*—7·33 in. (drought year).

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Improved Yellow Dent (Queensland)	30·67	3 *et seq.*
2. Leaming (New South Wales)	25·9	5 *et seq.*
3. Fitzroy (College)	24·5	7 *et seq.*
4. Kennedy (New South Wales)	22·7	7 *et seq.*
5. Golden Nugget (New South Wales)	19·8	10 *et seq.*
6. Golden Superb (New South Wales)	19·5	11
7. Golden Beauty (Queensland)	16·4	..
8. Yellow Hogan (New South Wales)	15·8	..
9. Giant White (New South Wales)	15·6	..
10. Hickory King (New South Wales)	14·4	..
11. Fitzroy (New South Wales)	14·2	..

S.E. of a mean treatment yield = 1·73 bushels per acre.
Differences exceeding 3 S.E. or 5·2 bushels per acre are significant.

Season 1932-33.

Plan.—8 by 8 Latin Square. *Plot Size.*—Ten rows, 1 chain long.
Planting Date.—23rd November, 1932. *Rainfall over Growing Period.*—19·23 in.

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Fitzroy (New South Wales)	54·55	4 *et seq.*
2. Improved Yellow Dent (Queensland)	53·73	4 *et seq.*
3. Fitzroy (College)	52·83	5 *et seq.*
4. Leaming (New South Wales)	49·65	5 *et seq.*
5. Golden Nugget (New South Wales)	45·55	6 *et seq.*
6. Red Nib	36·68	7 *et seq.*
7. Kennedy (New South Wales)	31·98	8
8. Golden Superb (New South Wales)	28·65	..

S.E. of a mean treatment yield = 1·09 bushels per acre.
Differences exceeding 3 S.E. or 3·27 bushels per acre are significant

SUMMARY OF RESULTS.

(BUSHELS PER ACRE—14 PER CENT. MOISTURE.)

—	1925-26.	1926-27.	1927-28.	1928-29.	1929-30	1930-31.	1931-32.	1932-33.
Fitzroy (New South Wales)	19·49	42·88	62·81	57·9	73·57	49·00	14·20	54·55
Improved Yellow Dent (Queensland)	19·11	41·33	60·21	59·9	67·59	51·0	30·7	53·73
Golden Nugget	10·38	37·17	49·05	63·3	57·27	46·28	19·8	45·55
Yellow Hogan	17·05	34·93	44·49	55·9	59·92	48·51	15·8	..
Golden Beauty (Queensland)	14·71	29·6	46·17	55·2	59·59	44·9	16·4	..
Golden Beauty (New South Wales)	12·07	24·62	37·15	37·3	48·26	..	..	..
Red Hogan (College) ..	21·95	28·41	45·27	..	..	..	..	..
Funk's Yellow Dent ..	16·42	..	..	..	..	..	..	..
Fitzroy (College)	..	..	..	58·7	66·98	47·32	24·5	52·83
Leaming	..	..	..	59·2	67·27	56·16	25·9	49·65
Giant White	..	..	..	56·4	56·13	41·69	15·6	..
Hickory King	..	..	..	54·7	59·83	44·17	14·44	..
Improved Yellow Dent (College)	..	..	..	59·4	62·11	50·4	..	..
Manning Silvermine ..	..	..	..	51·0	56·49	..	..	..
Kennedy	..	..	..	..	..	45·23	22·7	31·98
Golden Superb	..	..	..	..	..	43·11	19·5	28·65
Red Nib	..	..	..	..	..	..	..	36·68

COMPOSITE RESULTS.

The method of analysis is as for Randomised Blocks, each season being treated as a block. (*Maskell.*)

In each analysis only the longest period available for the varieties included has been given.

Period 1925-26 to 1927-28 (3 Seasons.)

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Fitzroy (New South Wales)	41·7	3 *et seq.*
2. Improved Yellow Dent (Queensland)	40·15	5 *et seq.*
3. Golden Nugget (New South Wales)	32·2	..
4. Yellow Hogan (New South Wales)	32·2	..
5. Red Hogan (College)	31·9	..
6. Golden Beauty (Queensland)	30·17	..
7. Golden Beauty (New South Wales)	24·6	..

S.E. of a mean treatment yield is 2·69 bushels per acre.

Differences exceeding 3 S.E. or 8·06 bushels per acre are significant.

Mean = 33·3 bushels per acre. Significant difference = 24·2 per cent. of mean.

Period 1925-26 to 1929-30 (5 Seasons.)

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Fitzroy (New South Wales)	51·34	3 *et seq.*
2. Improved Yellow Dent (Queensland)	49·6	4 *et seq.*
3. Golden Nugget (New South Wales)	43·5	6
4. Yellow Hogan (New South Wales)	42·5	6
5. Golden Beauty (Queensland)	41·1	6
6. Golden Beauty (New South Wales)	31·9	..

S.E. of a mean treatment yield = 2·29 bushels per acre. Differences exceeding 3 S E. or 6·87 bushels per acre are significant.

Mean = 43·3 bushels per acre. Significant difference = 15·8 per cent. of mean.

Period 1925-26 to 1931-32 (7 Seasons.)

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Improved Yellow Dent (Queensland)	47·1	3 *et seq.*
2. Fitzroy (New South Wales)	45·7	3 *et seq.*
3. Golden Nugget (New South Wales)	40·5	..
4. Yellow Hogan (New South Wales)	39·5	..
5. Golden Beauty (Queensland)	38·1	..

S.E. of a mean treatment yield = 1·64 bushels per acre.
Differences exceeding 3 S.E. or 4.91 bushels per acre are significant.
Mean = 42·2 bushels per acre. Significant difference = 11.6 per cent. of mean.

Period 1925-26 to 1932-33 (8 Seasons.)

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Improved Yellow Dent (Queensland)	48·6	3
2. Fitzroy (New South Wales)	47·5	3
3. Golden Nugget (New South Wales)	41·7	..

S.E. of a mean treatment yield = 1·02 bushels per acre.
Differences exceeding 3 S.E. or 3·05 bushels per acre are significant.
Mean = 45·9 bushels per acre. Significant difference = 6.7 per cent. of mean.

Period 1928-29 to 1929-30 (2 Seasons.)

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Fitzroy (New South Wales)	65·75	8 *et seq.*
2. Improved Yellow Dent (Queensland)	63·75	11 *et seq.*
3. Leaming (New South Wales)	63·25	11 *et seq.*
4. Fitzroy (College)	62·85	11 *et seq.*
5. Improved Yellow Dent (College)	60·75	12
6. Golden Nugget (New South Wales)	60·3	12
7. Yellow Hogan (New South Wales)	57·9	12
8. Golden Beauty (Queensland)	57·35	12
9. Hickory King (New South Wales)	57·25	12
10. Giant White (New South Wales)	56·25	12
11. Manning Silvermine (New South Wales)	53·75	12
12. Golden Beauty (New South Wales)	42·8	..

S.E. of a mean treatment yield = 2·71 bushels per acre.
Differences exceeding 3 S.E. or 8·14 bushels per acre are significant.
Mean = 58·5 bushels per acre. Significant difference = 13·9 per cent. of mean.

Period 1928-29 to 1930-31 (3 Seasons.)

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Leaming (New South Wales)	60·9	8 *et seq.*
2. Fitzroy (New South Wales)	60·16	9 *et seq.*
3. Improved Yellow Dent (Queensland)	59·5	10
4. Fitzroy (College)	57·6	..
5. Improved Yellow Dent (College)	57·3	..
6. Golden Nugget (New South Wales)	55·6	..
7. Yellow Hogan (New South Wales)	54·8	..
8. Golden Beauty (Queensland)	53·2	..
9. Hickory King (New South Wales)	52·9	..
10. Giant White (New South Wales)	51·4	..

S.E. of a mean treatment yield = 2·36 bushels per acre.

Differences exceeding 3 S.E. or 7·08 bushels per acre are significant.

Mean = 56·34 bushels per acre. Significant difference = 12·5 per cent. of mean.

Period 1928-29 to 1931-32 (4 Seasons.)

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Improved Yellow Dent (Queensland)	52·3	5 *et seq.*
2. Leaming (New South Wales)	52·15	6 *et seq.*
3. Fitzroy (College)	49·4	8 *et seq.*
4. Fitzroy (New South Wales)	48·7	9
5. Golden Nugget (New South Wales)	46·7	..
6. Yellow Hogan (New South Wales)	45·0	..
7. Golden Beauty (Queensland)	44·0	..
8. Hickory King (New South Wales)	43·3	..
9. Giant White (New South Wales)	42·45	..

S.E. of a mean treatment yield = 1·82 bushels per acre

Differences exceeding 3 S.E. or 5·47 bushels per acre are significant.

Mean = 4·71 bushels per acre. Significant difference = 11·6 per cent. of mean.

Period 1928-29 to 1932-33 (5 Seasons.)

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Improved Yellow Dent (Queensland)	52·6	..
2. Leaming (New South Wales)	51·7	..
3. Fitzroy (College)	50·1	..
4. Fitzroy (New South Wales)	49·8	..
5. Golden Nugget (New South Wales)	46·5	..

Fisher's "Z" test showed no significance in the results.

Period 1930-31 to 1932-33 (3 Seasons.)

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Improved Yellow Dent (Queensland)	45·1	..
2. Leaming (New South Wales)	43·9	..
3. Fitzroy (College)	41·5	..
4. Fitzroy (New South Wales)	39·3	..
5. Golden Nugget (New South Wales)	37·2	..
6. Kennedy (New South Wales)	33·3	..
7. Golden Superb (New South Wales)	30·4	..

Fisher's "Z" test showed that no differences were significant.

Summary of Composite Results.

The composite results may be summarised as under, significant differences only being included :—

Variety.	Superior to.	Inferior to.
1. Improved Yellow Dent (Queensland)	6–13	..
2. Fitzroy (New South Wales)	6–13	..
3. Leaming (New South Wales)	8–13	..
4. Fitzroy (College)	10–13	..
5. Improved Yellow Dent (College)	13	..
6. Red Hogan (College)	..	1, 2
7. Golden Nugget (New South Wales)	13	1, 2
8. Yellow Hogan (New South Wales)	13	1, 2, 3
9. Golden Beauty (Queensland)	13	1, 2, 3
10. Hickory King (New South Wales)	13	1–4
11. Giant White (New South Wales)	13	1–4
12. Manning Silvermine (New South Wales) ..	13	1–4
13 Golden Beauty (New South Wales)	..	1–5, 7–12

Discussion.

The results bring out clearly the need for replication over a number of seasons, and the danger of basing conclusions on the results of a single trial. Thus in 1931-32, a drought year, Fitzroy (New South Wales) came last, being significantly inferior to six other varieties, yet in the majority of seasons it has occupied a high place, and it is shown by a study of the composite results to be one of our most valuable varieties. Golden Nugget provides a similar case.

Another point of importance is the increased refinement in selection made possible when the trials are continued for several years. Thus for the composite results for the years 1925-26 and onwards it is seen that with trials over the first three years only differences of 24 per cent. of the mean can be adjudged significant. Over five years a difference of 15·8 per cent. of the mean is significant, over seven years 11·6 per cent., and over eight years 6·7 per cent. In other words, over the first three years only a difference of 8 bushels per acre is significant, over five years 6·87, over seven years 4·9, and over eight years 3·05 bushels per acre.

In the course of time new varieties were introduced into the trials, and those varieties which were proved inferior were from time to time discarded. After 1927-28, Red Hogan, although doing reasonably well, was discarded on account of commercial prejudice against its colour, and partly because of its starchiness and its being somewhat susceptible

to weevil. Golden Beauty (New South Wales) had by 1930 been definitely proved unsuitable, and Manning Silvermine was discarded at the same time. By 1932 the Queensland strain of Golden Beauty, together with Yellow Hogan, Giant White, and Hickory King, had proved their inferiority under Lockyer conditions, and these varieties were accordingly deleted. Improved Yellow Dent was not grown as a College farm crop after 1931, so that it became impossible to continue this variety for lack of seed.

Conclusions.

1. Improved Yellow Dent, Fitzroy, and Leaming prove to be the outstanding varieties (of those so far tested) for Lockyer Valley conditions. It is to be noted that of these the former two are late types, while Leaming is a mid-season variety.

2. Golden Nugget is also good, but slightly inferior to these three.

3. The varieties Red Hogan, Yellow Hogan, and Golden Beauty give fair yields, but are definitely inferior to the first three.

4. The strain of Golden Beauty, sold by the New South Wales Department of Agriculture, is definitely unsuited to the conditions of the Lockyer. Giant White, Manning Silvermine, and Hickory King are also inferior, and none of these varieties can be recommended for such districts as the Lockyer Valley.

5. The value of the varieties Kennedy, Golden Superb, and Red Nib has not yet been proved, and no recommendation can at present be made with regard to them.

6. It must be emphasised that these results are applicable only to the Lockyer Valley and to districts having similar soils and climatic conditions.

Other varieties are now under test, and in the season 1933-34 the varieties Funk's 90-Day and Durum are being added to the eight tested in 1932-33. The trials will be continued from year to year, and progressive results published when possible.

Acknowledgments.

The authors wish to express their gratitude to Professor J. K. Murray for his keen interest throughout the work and for his ready provision of facilities to carry it out. The bulk of the field work was ably done by Mr. E. McCarthy, Assistant to Plant Breeder. To the various assistants in the Plant Breeding Section who have from time to time assisted in various ways we also tender our thanks.

Thanks are also due to the State Departments of Agriculture of Queensland and New South Wales for having made the necessary supplies of seed available.

REFERENCES.

1. R. A. Fisher and J. Wishart. Imp. Bur. Soil Sci. Tech. Comm. No. 10.

2. E. J. Maskell. Trop. Agr. Vol. 5, No. 12; Vol. 6, Nos. 1, 2, 4.

NOTE.—Supplies of pure seed of Improved Yellow Dent may be obtained from the Department of Agriculture and Stock, Brisbane, and of Fitzroy from the Queensland Agricultural High School and College, Gatton.

Red maize is definitely unsuitable for export requirements, and there is also prejudice against it in local markets. In view of these facts and also on account of the proved superiority of yellow maize in these trials, the discontinuance of the use of red-grained types and the extension of the use of yellow types is strongly recommended.

QUEENSLAND VENEER TIMBERS.

More than twenty timbers in all shades of ornate colour and variety of figuring are available within the State for veneer and plywood purposes of all kinds, while the efficiency of the factories is such that the humblest cottage can be made beautiful by the use of choice veneered panels at low cost.

Such a natural advantage as this, coupled with the variety of native hardwoods of unexcelled durability eminently suitable for exterior sheetings and polished internal floorings, may well make home builders in other lands envious of their friends in Queensland.

In addition to work provided for timber and transport workers, the Queensland Veneer and Plywood Industry in 1933 provided direct employment for 448 hands in its factories.

Although the industry is only eighteen years old in this State, the capital invested has already grown to £370,000, and Queensland factories are now capable of supplying more than the present demand of the whole of the Australian States and New Zealand.

The following notes on Queensland veneer timbers, taken from a brochure entitled "The Veneer and Plywood Industry of Queensland," published by the Sub-Department of Forestry, Department of Public Lands, Queensland, will be read with interest by farmers and others who appreciate the economic value of Queensland woods. The fine plates illustrating this article are also reproduced through the courtesy of the Sub-Department of Forestry.

QUEENSLAND possesses a range of valuable veneer woods, which for beauty and utility are unsurpassed in any country of the world.

Many of the most famous cabinetwoods of the Old and New World are being replaced by Queensland woods of similar colour, figure, and lustre, capable of giving equal service under the most exacting conditions.

Foremost among these are Queensland Walnut, which is often almost identical in appearance to the best Italian and American Walnut, Maple Silkwood, a Mahogany type, and Silky Oak, the quartered figure of which surpasses that of the European Oaks while offering much greater facilities for working.

Ripple figured quarter sliced veneers of Queensland Satinay remind one strongly of figured Mahogany, while rotary-peeled Red Tulip Oak shows a particularly handsome soft tissue figure of tapestry effect which has no parallel in any other known wood.

Hoop Pine is the standard Queensland timber for all plywoods for plain joinery work, and is most largely used for the internal plies and cores of all types.

Following are short descriptions of the more important veneer woods in Queensland with particular reference to their botanical and trade nomenclature, sources of supply and log size, timber qualities, and uses.

QUEENSLAND WALNUT.

(Endiandra palmerstoni.)

The close resemblance of this wood to the Walnuts of the Northern Hemisphere gained for it the names of Queensland Walnut and Black Walnut from the date of its first discovery.

In the American trade, it became known variously as Australian, Oriental, and Queensland Walnut, Australian Laurel, and Oriental Wood, the last name being finally adopted by the Federal Trade Commission for the sole use of the trade in the United States.

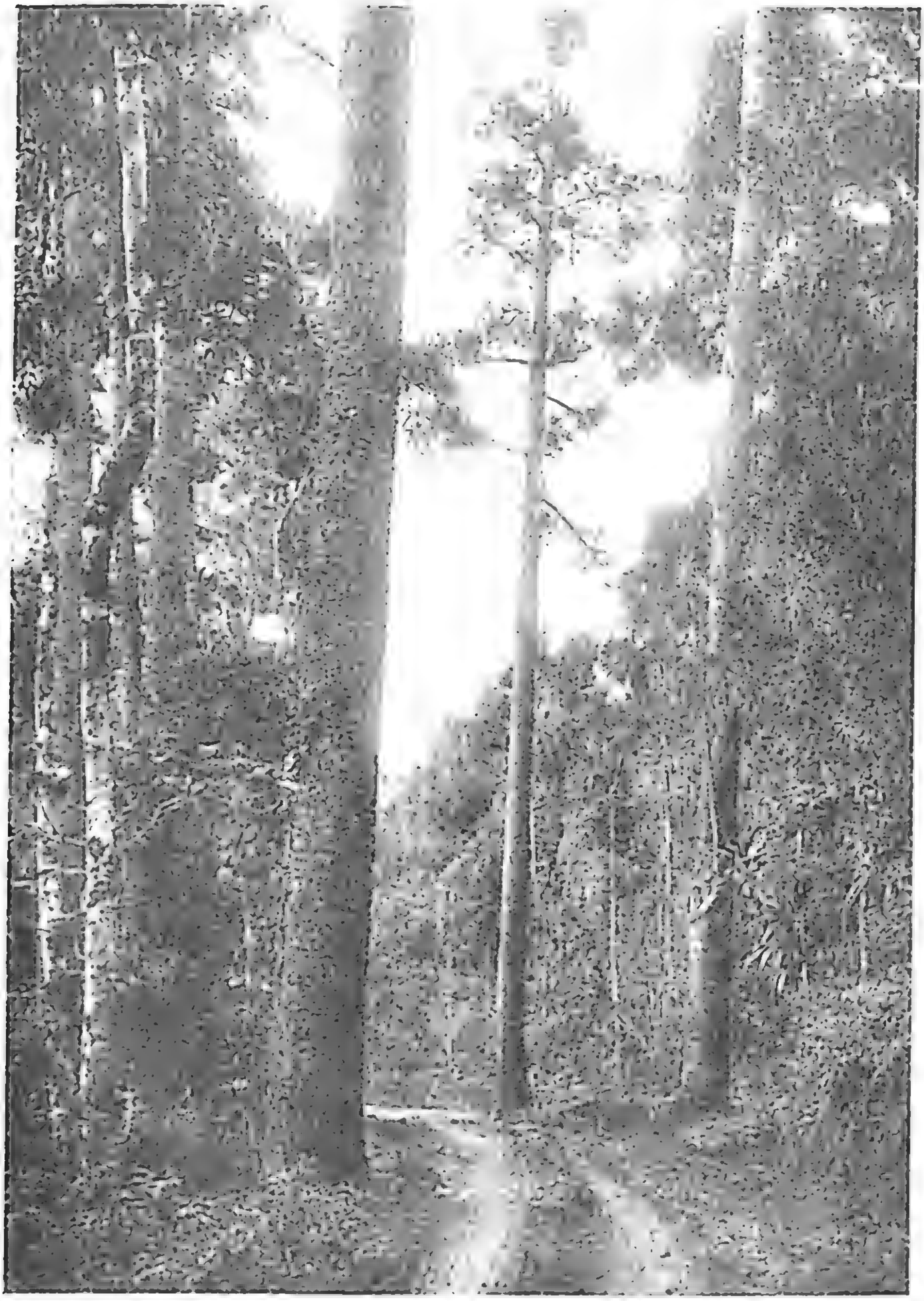

Plate 43.—Veneer Logs in Hoop Pine Forest, South Queensland.

Walnut is one of the largest of Queensland trees, and is available only on the coastal Tablelands of North Queensland from Innisfail to Atherton, with Cairns as the port of shipment.

Mature trees attain a height of 120 to 140 feet, yielding boles up to 80 feet in length. Logs are sold in six classes ranging in measurement from 8 feet to 13 feet and over, centre girth under bark. They are not always, however, perfectly sound.

PLATE 44.—QUEENSLAND WALNUT, 9-FEET GIRTH (BREAST-HIGH), NORTH QUEENSLAND.

It has been estimated that some 40,000,000 superficial feet of Walnut logs are available in North Queensland.

Queensland Forest Service records show that Walnut was first recommended for veneering work in 1917. In February, 1922, the first veneering was done in Queensland by Messrs. D. G. Brims Limited, at Milton, on a log specially obtained from Atherton. The timber was found to peel exceptionally well for rotary-cut veneer, although dulling the knife edges a little more than other woods. Standard

sheets of three-ply were exhibited in the British Empire Exhibition, and the remainder were used for panelling the old Forest Products Showroom in William street, and for trade samples. The possibilities of Walnut were recognised by the Forest Service, and a strong publicity campaign was inaugurated. From this modest beginning developed the present overseas demand for this timber.

By 1925 a number of Walnut logs had been sold to local plywood manufacturers, but the plywood did not at once become popular, notwithstanding its attractive figure. Plywood made in Brisbane was at first all of the rotary type, and no

Plate 45.—Queensland Maple, 10-feet Girth (breast-high).

attempt was made to obtain the still more beautifully striped or rippled figure by the cutting of the veneers radially by a slicing machine. In Sydney, however, Messrs. Beale and Company used sliced veneers with excellent effect on Australian-made pianos and furniture panels.

Towards the end of 1927 a strong demand for Walnut logs arose in America, which had the effect of greatly reviving the timber trade in North Queensland

after months of depression. By March, 1928, more than 300,000 superficial feet of logs had been shipped to American veneering works. Here it was sold chiefly as Oriental Walnut, later becoming known also as Australian and Queensland Walnut, and from its family (Lauraceæ) Australian Laurel.

Strong objections were raised to the use of the name "Walnut" for the timber by the American Walnut Association, who contended that it was not a true Walnut. There is little doubt that this objection was due to the very successful competition of the Queensland wood for the same purposes as the American Walnut (*Juglans nigra*) which it strongly resembles.

PLATE 46.—SILKY OAK TREE (CARRYING FERNS) IN NORTH QUEENSLAND FOREST.

It was finally decided by the American Trade Commission that the wood must be sold only as Oriental Wood in the United States.

From July, 1928, the demand for Walnut logs greatly increased, and up to the end of the year over 2,000,000 superficial feet were exported to America alone. For the first six months of 1929 the quantity exported to America was 2,808,000 superficial feet, valued at £49,000 at the point of shipment. Exports were made chiefly to America, the United Kingdom, Canada, France, and Germany in order of quantity.

For the year July, 1931, to June, 1932, Queensland Forest Service records show that 1,296,000 superficial feet (Hoppus) of Walnut logs were removed from Crown lands in North Queensland. This represents an increase of 60 per cent. on the Crown sales for 1930-31.

In 1932-33, 560,000 superficial feet were sold.

Under the name of Australian or Oriental ''Walnut'' the following extracts are taken from Tropical Woods (1st June, 1929) as published by the Yale University, United States of America:—

> ''The most recent addition to the American market of so-called Walnut woods is from Queensland, Australia. It appears to have been first introduced in 1927, by Russell Fortune, of Indianapolis, Ind., and has since become a serious competitor of American Walnut. It is known to the trade as Oriental Walnut, Oriental wood, Australian Walnut, Australian Laurel, and Queenswood.
>
> ''The Imperial Institute (Descriptive List of some Empire Timbers, London, 1928, pp. 11-12) reports as follows:—'Queensland Walnut—A moderately heavy timber of a pale chocolate-brown colour, somewhat open in the grain and often presenting a fine wavy figure; a streaked figure sometimes occurs. The wood seasons rapidly, works well under the tool, planes to a smooth surface, and takes a good finish and polish. Weight 46 lb. per cubic foot. An excellent substitute for American Walnut. It is well suited for high-class furniture, cabinetwork, joinery, and interior decorative purposes, and is suggested for the manufacture of aircraft propellers. The streaked timber is valued for veneer, which is well suited for shopwindow and other panelling. Queensland Walnut would be useful for many purposes where a strong timber of good appearance is required.'
>
> ''Mr. Karl Schmieg, recognised authority on cabinet-making and design, says:—'Queenswood (i.e., Queensland Walnut) is a remarkably fine wood, which runs very sound and uniform, keeps straight, takes glue well, and can be readily stained and polished. It has a greenish-yellow tinge and dark stripes, suggesting French Walnut more than the others, and is appropriate for use in combination with Ash, Oak, or any kind of Walnut. We have not used it in solid lumber, but have recently made a modern bedroom set to serve as a model for four hundred others for a hotel, and all of the surfaces, such as end panels, tops, and drawer fronts, are of Queensland veneer. I consider the wood suitable for modern interiors of offices, clubs, and hotels. The price at present is very reasonable.' ''

A member of the American Walnut Manufacturers' Association made the following remarks regarding Queensland Walnut logs shipped to America:—

> '' The logs are very striking in appearance, most of them from 14 to 16 feet long and running in diameter of from 30 inches to 40 inches. The bark has the appearance of Beech bark, except that it is reddish rather than grey. The sapwood is tremendous, the ring running from 2 inches to 3 inches wide. The sapwood is of a pinkish colour, and no way has been found to use it.
>
> ''Forty to fifty per cent. of the logs show some kind of a figure. There is a great variation in this figure, but a mottle cross figure is not uncommon. When the plain wood is quartered, it produces a striped figure, not unlike the stripe to be obtained from American Walnut. It is this type of wood that has been in greatest demand, since much greater width quarters can be obtained from these large logs than from American Walnut.
>
> ''Its advantages are that the veneers come wide and long; therefore can be used with the least pessible waste. It is also economical from the standpoint of price.''

The dark-striped ''Walnut'' figuring of Queensland Walnut seen most prominently in quarter-sliced veneers is due to decided variations in the depth of colour in the concentric growth rings of the trunk.

Mottled, fiddleback, and ripple figuring are the result of the interlocking of the wood fibres, and show the best effects in quartered veneers.

The following excellent description of this beautiful wood is taken from a publication issued by an American veneer manufacturer:—

> "Very few commercial woods exhibit such a variety of attractive colours as this native of Queensland's forest. While there are many odd shades, difficult to briefly describe, the most prominent are the 'Salmon Red,' the 'Walnut tint,' and a third group ranging from grey to brown. In spite of the extreme variations of shades afforded by individual specimens, the logs are massive and, as previously stated, produce a large amount of veneer, rendering it easy to procure uniformly coloured material, even for large dimensioned wood work.
>
> "Although the Oriental wood can be worked advantageously on the rotary lathe, the grain of the wood favours it being cut on the quarter. The figure thus produced consists of more or less parallel stripes of varying width which are often interrupted by rich cross figures of different types, the most common of which are the 'fiddleback,' 'broken roe,' 'mottle,' and 'finger roll' markings."

PLATE 47.—SNIGGING VENEER LOGS WITH TRACTOR IN A NORTH QUEENSLAND FOREST.

The use of Queensland Walnut veneered panelling, under the name of "Oriental" Walnut, in the carriages of the famous European tourist train "Golden Arrow" is a striking tribute to the beauty and utility of this valuable wood. This train is reputed to be the most luxurious in the world.

A considerable amount of veneering and panelling work in Queensland Walnut has also been carried out at the headquarters of the British Broadcasting Corporation.

PLATE 48.—TWO RED TULIP OAKS, 9-FEET GIRTH (BREAST-HIGH), NORTH QUEENSLAND.

In Australia, Walnut veneered panels are used largely in the construction of high-class furniture, radio cabinets, and for the wall panelling of the best homes and public buildings. It has been used to an increasing extent in recent years with excellent effect in panelling the principal rooms of modern homes erected in Brisbane under the supervision of leading architects. For the best work quarter-sliced matched panels are most favoured.

MAPLE SILKWOOD.

(*Flindersia brayleyana* and *Flindersia pimenteliana.*)

Two distinct botanical identities are included under the official name Maple Silkwood, but the timbers are so similar with regard to colour, figure, and working qualities that they are grouped together for trade purposes. In North Queensland, *Flindersia brayleyana,* once called Red Beech, is now commonly known as Queensland Maple, while *Flindersia pimenteliana* is called Silkwood.

In the American trade the timber has been called Warri Wood.

Maple Silkwood grows only on the tablelands and coastal areas of the Atherton district in North Queensland. Both species attain a height of over 100 feet and logs are sold with girths ranging from 6 feet to over 14 feet measured under the bark at the centre. *Flindersia pimenteliana* usually produces a slimmer bole and is much less abundant.

The latest estimates of the quantity of Maple Silkwood available on Crown lands in North Queensland (December, 1929) are:—

Girth 8 feet and over (breast high) ..	77,000,000 superficial feet
Girth 5 feet to 8 feet	30,000,000 superficial feet
Total	107,000,000 superficial feet

To enable a sustained supply of this valuable timber to be secured for the future, the annual cut from Crown lands was regulated to 3,000,000 superficial feet for the three years from January, 1930, to January, 1933, but these limits were not reached by sales during this period. The minimum girths cut were 9 feet on the Tableland and 8 feet on the Coast and Molloy areas. Nearly 8,000,000 superficial feet of logs were cut on Crown lands during the five and a-half years period from January, 1924, to June, 1929, and nearly 3,500,000 superficial feet were cut in three years from July, 1929, to June, 1932.

The Department's policy of reforestation of this species will perpetuate supplies of Maple Silkwood.

Maple Silkwood is recognised as the finest cabinetwood in Australia. The wood has a pleasing flesh-pink colour with the lustre of satin. Quarter-sliced veneers almost always show a ribbon figure. The broken ribbon and ripple figuring found in butt veneers are particularly beautiful, having the appearance of shot silk. The best veneers are obtained from stumps, butt logs, and crotches of well-matured trees.

Maple Silkwood ranks as one of the best veneer woods of the world. It cuts cleanly without splitting and very wide and thin veneers can be successfully sliced.

The wood is very tough, and is almost equal in strength to English Oak.

Tests made by the Technological Museum, Sydney, on seasoned timber, gave the following results:—

Weight per cubic foot—37 lb.
Modulus of Rupture—13,300 lb. per square inch.
Modulus of Elasticity—1,649,000 lb. per square inch.

The average weight of seasoned timber is approximately 40 lb. per cubic foot.

Maple Silkwood responds readily to ammonia fuming, turning to attractive grey tones while enhancing the natural figuring.

For interior work it is very durable, and is prized for veneered furniture, panelling, doors, shop and office fittings, and joinery generally.

The beautiful symmetrical effects obtainable by the use of veneers of figured Maple Silkwood are well illustrated by the panelled work in the Board Room at the Headquarters of the National Society of Operative Printers and Assistants, Borough road, London.

In Australia Maple Silkwood matched panels are extensively used in the manufacture of the best furniture, where it is used for table tops, sideboard and wardrobe front panels and ends, dressing-table drawer fronts, and bedstead ends.

Maple Silkwood plywood is eminently suitable for aircraft work for which it is classed with Honduras Mahogany. Made to exacting specifications, Maple Silkwood plywood is utilised in wing and body sheeting, body bulkheads, and cabin furniture.

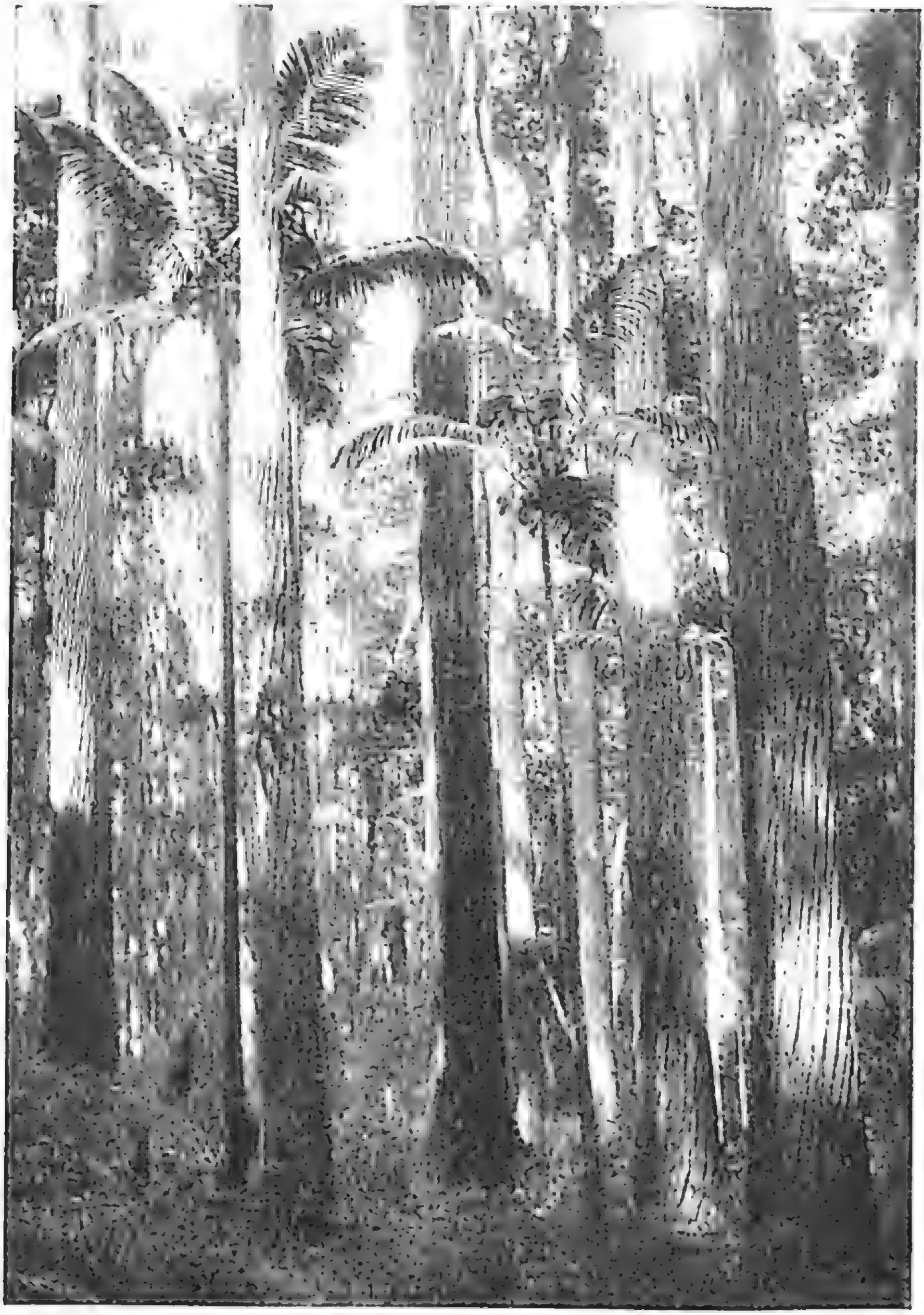

Plate 49.—Satinay Forest, Fraser Island, Queensland.

PLATE 50.—TRACTOR LOGGING IN HOOP PINE FOREST, CANUNGRA DISTRICT.

Plate 51.—"The Triplets."
Hoop Pines at Cainbable, Sarabah Range, South Queensland.

SILKY OAK.

(*Cardwellia sublimis.*)

The original Silky Oak of the Australian market was produced by two species (*Orites excelsa* and *Grevillea robusta*) occurring in the coastal areas of Southern Queensland and Northern New South Wales, but the North Queensland species (*Cardwellia sublimis*), is the Silky Oak of the veneer trade.

The three species, although somewhat alike in appearance and belonging to the same family, have different properties, the Northern species being superior for veneer purposes and providing the best logs.

Silky Oak (*Cardwellia sublimis*) is the largest tree of its family and is found only in the coastal areas in the vicinity of Innisfail and Cairns, North Queensland. The tree reaches a total height of 120 feet and its massive bole provides logs up to 10 feet and more in girth. The tree first known as Silky Oak in North Queensland was *Embothrium wickhamii* of the same family, and the present Silky Oak of the furniture trade was then more commonly called Bull Oak.

In America it is known as Lacewood, probably because of the lace-like appearance of rotary-cut veneers.

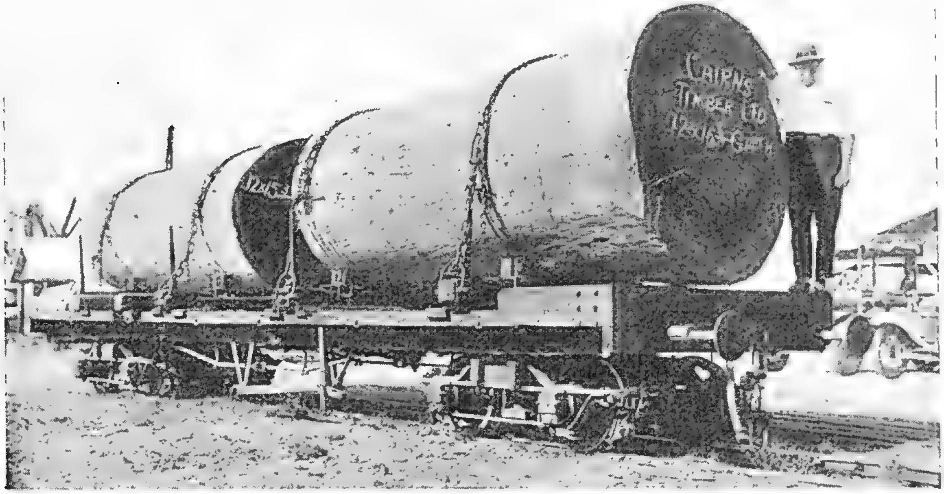

PLATE 52.—KAURI PINE LOGS.

The most recent estimate gives the quantity of Silky Oak log timber available on Crown lands in North Queensland as 105,000,000 superficial feet (Hoppus) of which 70,000,000 superficial feet is in logs measuring 8 feet and over in girth.

To provide for the future requirements of the timber industry while trees growing under sylvical operations attain milling size, the Queensland Forest Service in January, 1930, limited the annual log cut for a period of three years to 2,000,000 superficial feet. For the year 1932-33 998,000 superficial feet were sold by the Crown.

Customs figures for Queensland for 1932 show that 576,000 superficial feet of sawn Silky Oak were exported to United Kingdom alone during the year. This indicates that this timber is gaining in popularity abroad, and the greater use of veneered panels is following in the wake of the increased demand for sawn timber.

Silky Oak is second only to Maple Silkwood in popular esteem for cabinet purposes in Australia.

The timber is light and of a pale-pink colour, and owes its popularity chiefly to its ease of working and facility for staining coupled with its handsome "Oak" figuring, which can be varied by the angle of cutting with regard to its large medullary rays. The most striking "silver grain" is seen on quarter-sliced veneers.

When thoroughly seasoned, the wood has an average weight of 36 lb. per cubic foot.

Silky Oak is very tough for its weight and is excellent for holding screws. It takes glue readily but does not fume. On account of the weaving of the fibres through the large rays the transverse strength is considerably lower than that of Maple Silkwood, although ample for joinery and furniture purposes. The modulus of rupture averages about 8,000 lb. per square inch for good quality seasoned timber.

Plate 53.—Scarfing a Walnut Tree, 11-feet Girth, Atherton District.
Ripple Marks on Buttresses Indicate Figured Wood.

The wood is very durable even when exposed to the weather, and is a general favourite for casement windows which are usually oiled and varnished on the inside to show the attractive grain.

Silky Oak is well suited for veneering owing to its toughness and flexibility and the wide sheets which can be secured. Veneer sheets leave the knife smooth cut and free from checks.

Silky Oak plywood is extensively used for panelling in the best residences and in public banks, shops, and offices. It is also favoured for partitions, counters, and showcases.

In the furniture trade it finds extensive uses in wardrobes, sideboards, table-tops, and other articles framed in solid timber.

Much of the beauty of Silky Oak is often lost through incorrect methods of finishing. Judicious staining is necessary to bring up the natural figuring to the best effect.

PLATE 54.—ROSE ALDER, NORTH QUEENSLAND.

RED TULIP OAK.

(*Tarrietia argyrodendron* var. *peralata.*)

Red Tulip Oak represents the largest and most valuable tree of the Sterculiaceæ family in Australia. It is a native of the tropical coastal forests of North Queensland, where it occurs on the Atherton Plateau and northward along the ranges towards the Daintree River. The tree reaches a height of 120 feet with a bole sometimes exceeding 10 feet in girth above its widely spurred base.

Above the spurs, excellent logs for rotary veneering are usually available, the trunk being long, straight, and cylindrical in shape.

Logs in girths ranging from 7 feet upwards are sold by the Forest Service f.o.b. or f.o.r. Cairns. The total quantity of log timber in North Queensland available for marketing has been estimated at more than 200,000,000 superficial feet.

It has been found from experience that the best logs for veneering are those containing light, mild timber, cut on sheltered sites. Production of low-grade veneers has resulted from the cutting in error of the harder allied woods, Brown Tulip Oak (*Tarrietia argyrodendron*) and Blush Tulip Oak (*Tarrietia actinophylla*).

Red Tulip Oak is a handsome veneer timber with colour variations in brown and reddish shades. During 1932 it became the most popular wood for the internal panelling of modern Brisbane homes. For this work rotary-peeled plywood gives the most attractive results because of the beautiful tracery effect of the concentric bands of soft tissue prominently exposed on this section.

PLATE 55.—SILVER ASH VENEER LOG IN A NORTH QUEENSLAND JUNGLE.

Quarter-sliced veneers show the comparatively large medullary rays to the best advantage, but the general effect of the figuring is not so pleasing as that secured by rotary peeling.

Red Tulip Oak is a comparatively hard wood and has an average seasoned weight of approximately 50 lb. per cubic foot.

It is very strong and makes particularly strong plywood. A remarkable feature of the wood is its extremely high electrical insulating properties. Under test, rods 4 inches long have withstood a pressure of 33,000 volts for two minutes before failure.

For interior work Red Tulip Oak is very durable and gives long and satisfactory service. It is not adapted for exposure to the weather.

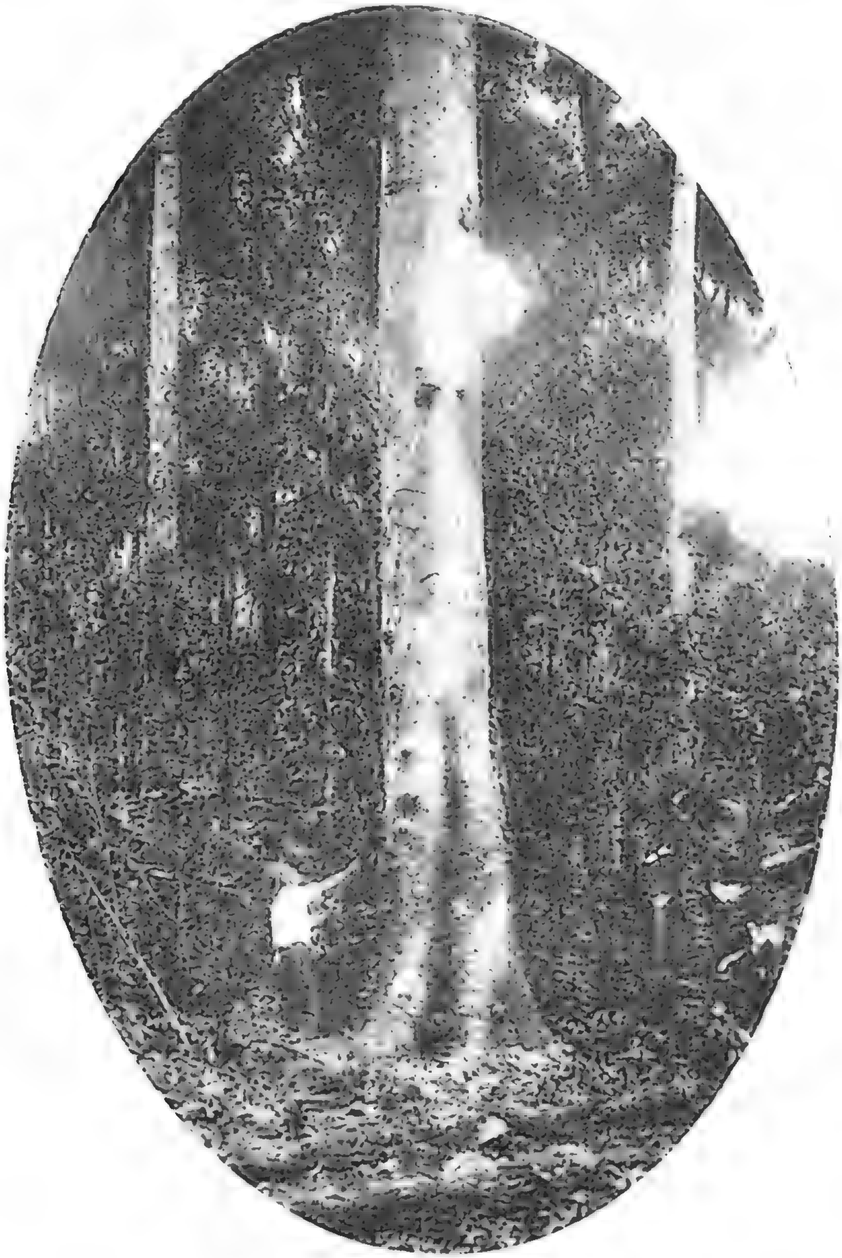

Plate 56.—Black Bean, 10 Feet in Girth, Atherton District, North Queensland.

Red Tulip Oak plywood is at present used chiefly for decorative panelling of private residences, and for shop and office fittings.

Where plywood panelling is used in interiors it is usual to use moulded cover strips, and art rails of the same or some other figured wood to give harmonious results.

Finished in light tones the plywood is regarded as specially suitable for the interior panellings of motor launches.

PRODUCING VENEER LOGS FOR THE FUTURE.

Plate 57.—Queensland Maple resulting from Natural Regeneration Operations.

Plate 58.—Hoop Pine Plantation, ten years old, Atherton District.

QUEENSLAND SATINAY.

(*Syncarpia hillii.*)

Queensland Satinay has been so named by the Queensland Forest Service because of its resemblance in colour and figuring to the Satiné of French Guiana.

The timber is found in quantity only on Fraser Island, which extends for 80 miles along the Queensland coast, 20 miles east of the port of Maryborough. It prefers the sheltered dells of the immense sandhills forming the backbone of the island, flourishing where the rainfall exceeds 60 inches per annum.

Forest Service field estimates place the available supplies at around 50,000,000 superficial feet. It grows rapidly, regenerates naturally very readily, and rationed supplies can be maintained in perpetuity. Logs are available in centre girths under bark from 6 to 9 feet and over, but the smaller logs are not subject to pipes and provide lighter and more mellow timber, better suited for veneering.

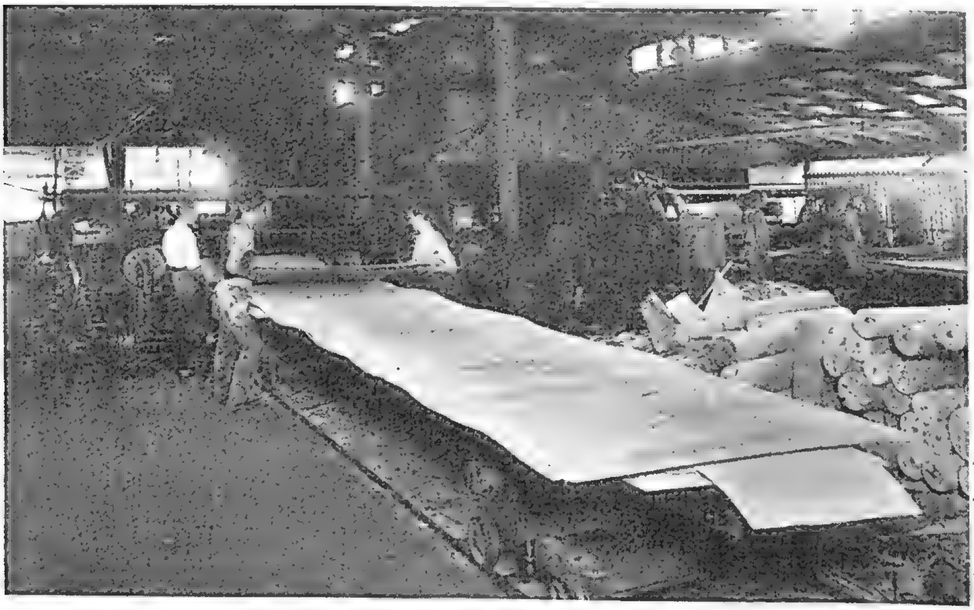

PLATE 59.—PEELING HOOP PINE LOGS ON ROTARY LATHE.

Queensland Satinay is a bright-pink close textured wood showing a beautiful lustrous broken ripple figuring on quarter-sliced veneers. By means of ammonia fuming the colour may be subdued to a greyish-plum tone, with velvet depths lit up by the ripple grain. Probably the most attractive treatment is the unique effect appropriately named "opal finish," because of the changing colours and light reflections of the undulating fibres produced by viewing the panels from different angles. For this purpose the veneers should be cut on the quarter at least $\frac{1}{8}$ inch in thickness. Made up panels are then fumed to dark tones in an airtight chamber and afterwards sanded down about one-sixteenth of an inch or until the natural pink colour of the wood appears, where the fibres lie parallel with the surface and the fuming process has not penetrated so deeply. The variegated effects in colour and shading are then seen. The most brilliant results are obtainable by polishing with transparent French polish. "Opal finish" can only be applied to those rare woods which react chemically with deepening colour under the influence of ammonia fumes, and possess strongly interlocked fibres.

Seasoned Satinay has an average weight of 50 lb. per cubic foot. Timber from less mature trees may fall as low as 46 lb., while the inner flitches of very large logs may weigh up to 56 lb. per cubic foot.

The wood is very strong and Satinay plywood is probably the strongest in Australia.

Plate 60.—Log Dump in Hoop Pine Forest, South Queensland.

Plate 61.—Ply Logs on the way to the Mill.

PLATE 62.—HAULING PINE LOGS, IMBIL, SOUTH QUEENSLAND.

Static bending tests made by the Technological Museum, Sydney, showed an average modulus of rupture of 14,800 lb. per square inch for small clear specimens of the wood; with an average compression result parallel to the grain of 7,800 lb. per square inch.

To obtain the easiest cutting of veneers from Satinay, the logs should be sliced as soon as possible after felling, or after thorough boiling. Logs should be greased on the ends immediately after felling to prevent drying and splitting on the ends.

While extremely durable under all conditions, Satinay is also highly fire resistant, ranking first in this respect among all Australian cabinetwoods. Except for the white sapwood, not used in veneers or furniture, Satinay is not attacked by wood borers of any kind.

Satinay veneers, quarter sliced and matched, give excellent effects in wall panelling and for door panels in furniture. Variations in the depth of colour can be obtained by fuming or finishing with the "opal finish" described above. Wall panelling in the Forest Products Showroom, Brisbane, has given splendid service for over five years although exposed to great extremes of heat and humidity. Queensland Satinay has now proved its value for plywood panelling, and its popularity is increasing.

Considerable interest in this timber has recently been shown in America.

QUEENSLAND PINE.

(*Araucaria* spp. and *Agathis* spp.)

Queensland Pine plywood is constructed principally of Hoop Pine (*Araucaria cunninghamii*) with Bunya Pine (*Araucaria bidwillii*) and North Queensland Kauri Pine (*Agathis palmerstoni* and *A. microstachya*) in smaller quantities.

Hoop Pine extends along the whole length of the Queensland coast following the coastal hillsides from the New South Wales border to Cape York, but the largest Queensland supplies are found in the south-eastern corner of the State extending westward about 100 miles to the main Dividing Range. Bunya Pine is not nearly so abundant as Hoop Pine, and has a very restricted range between Gympie and the Bunya Mountains in Southern Queensland. Kauri Pine, as used in the veneer industry grows only in the mountainous coastal area in the Cairns district, North Queensland.

According to present Forest Service estimates the Queensland stand of Hoop and Bunya Pine of mature size (60 inches girth and over) is approximately 800,000,000 superficial feet.

Logs of plywood class represent about 100,000,000 superficial feet of this total.

In North Queensland the quantity of Kauri Pine on Crown lands has been estimated at approximately 125,000,000 superficial feet for trees 8 feet and over in girth breast high. In girths from 5 feet to 8 feet a further 30,000,000 superficial feet are available.

Both the Hoop and Bunya Pines grow to a large size, reaching 150 feet and more in height with girths up to a maximum of 10 feet and more. Although Bunya Pine is usually stouter, both species provide long cylindrical boles, yielding clear logs excellent for veneering purposes.

Kauri Pine reaches much the same height, while providing a much thicker bole from which logs up to 18 feet, and sometimes greater, girth are available. In shape and size Kauri provides the best veneer log in Queensland.

Hoop and Bunya Pine logs are sold in girth classes of 5 feet and upwards, while Kauri logs are rarely sold below 8 feet.

Queensland Pine is a close and even textured, firm cabinetwood of the highest quality. Its ivory colour and smooth finish are particularly attractive to the joiner and cabinet-maker, providing a medium which can be readily stained and finished in any colour desired.

It has considerable toughness and strength but is easily worked, glues and stains perfectly, and is normally non-aromatic.

Seasoned Hoop Pine weighs approximately 36 lb. per cubic foot, while Bunya Pine and North Queensland Kauri Pine average 33 lb. and 30 lb. respectively.

Hoop Pine plywood has the greatest firmness of surface, followed closely by Bunya Pine, with North Queensland Kauri Pine a little softer.

PLATE 63.—KAURI PINE LOGS FROM COOKTOWN, NORTH QUEENSLAND.

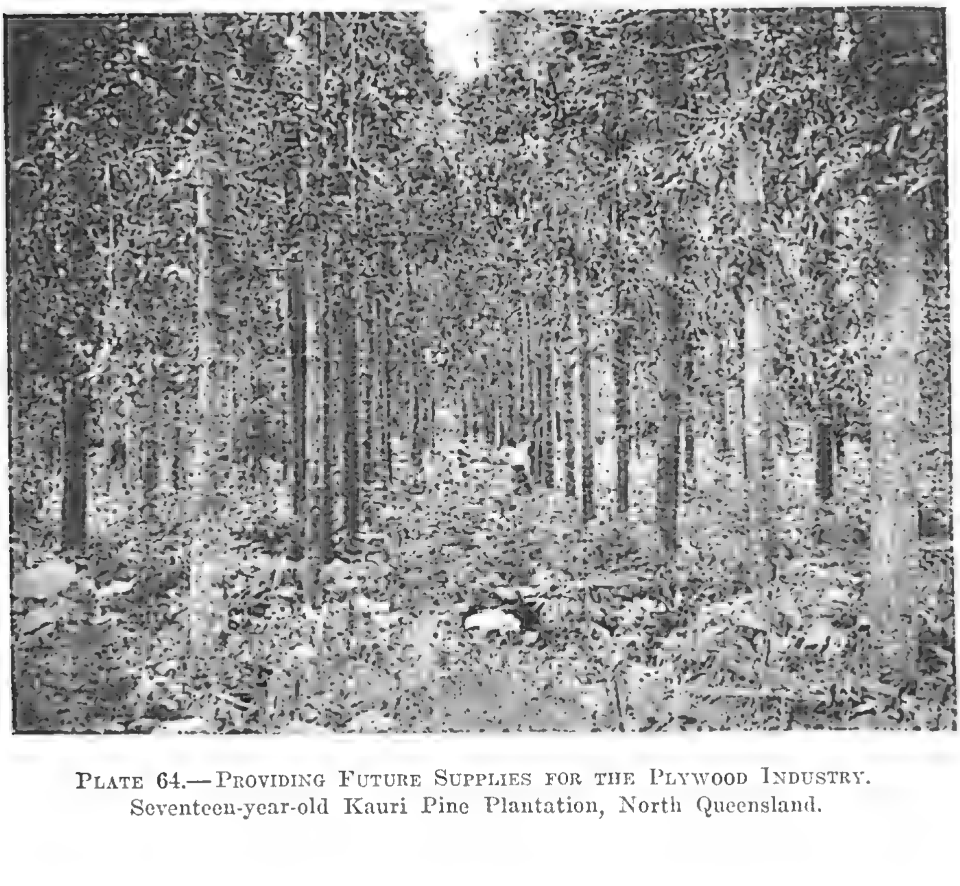

PLATE 64.—PROVIDING FUTURE SUPPLIES FOR THE PLYWOOD INDUSTRY.
Seventeen-year-old Kauri Pine Plantation, North Queensland.

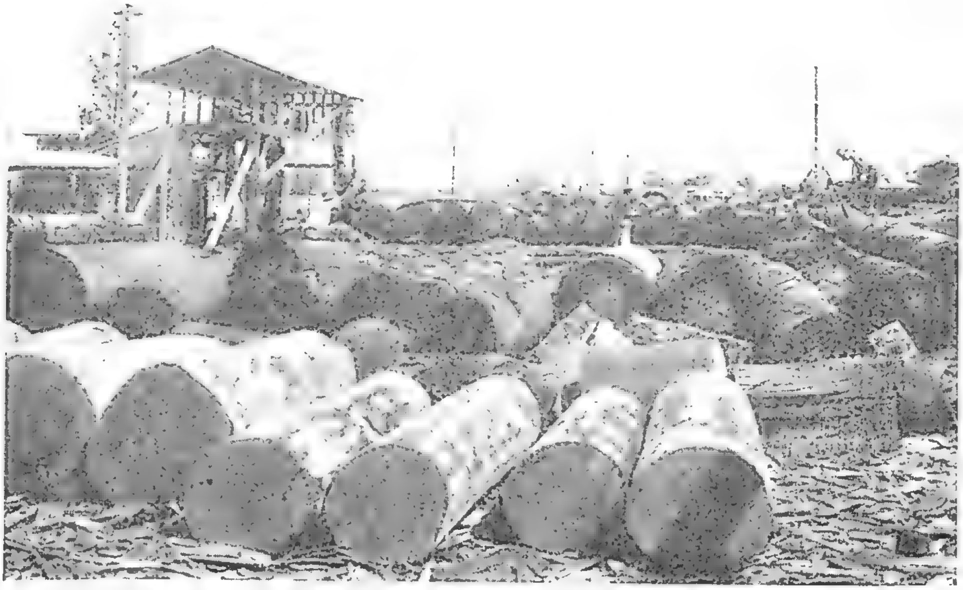

PLATE 65.—CLEANING AND CUTTING LOGS TO LENGTH PRIOR TO PEELING.

PLATE 66.—LOG ENTERING PIT FOR STEAMING BEFORE PEELING.

The colour of Hoop Pine is usually uniformly pale, while Bunya Pine frequently shows stronger figuring in pale-pink shades. Kauri is often seen in uniform shades of light-brown. Although unsuitable for outdoor use, these woods are very durable in interior furniture and joinery.

The relative strengths of Hoop and Bunya Pine compared with Oregon Pine (*Pseudotsuga taxifolia*) are given in the following table from Queensland Railway tests:—

Timber.	Number of Tests.	Moisture Content.	Transverse Modulus of Rupture.	Crushing (on end Grain).
		Per Cent.	Lb. per sq. in.	Lb. per sq. in.
Bunya Pine	3	14·6	13,870	7,830
Hoop Pine	7	13·8	12,830	7,620
Oregon Pine	20	11·3	10,840	6,780

Queensland pine is the standard plywood for all interior work to be stained, varnished, or painted. It is the best wood for corestock and centre plies in Australia, over nine-tenths of all the veneers cut being of Hoop Pine.

Queensland Pine plywood is very extensively used in the building industry for internal panellings, ceilings, door panels, and cabinets in houses, public buildings, and in shops and offices where it also finds service for counters, shelves, and partitions. In the furniture trade, stained and polished panels are used in medicine chests, wardrobes, dressing tables, bedsteads, and wardrobe doors and ends. It is also used almost exclusively for drawer bottoms, wardrobe mirror backs, and patterns.

Coachbuilders find the plywood of great service for linings, seats, and internal fittings of buses and trams. Boat builders use Hoop Pine for internal lining and panellings.

The Queensland dairy industry requires over 1,500,000 butter-boxes per annum, practically the whole of which are made of Hoop Pine and North Queensland Kauri Pine. The greater proportion of these are constructed in the form of wire-bound rotary-cut veneer boxes. Queensland Pine plywood also finds extensive use for a very large number of miscellaneous purposes, including camping kits, drawing boards, toys, and models, ping pong bats, radio cabinets, and waste-paper baskets.

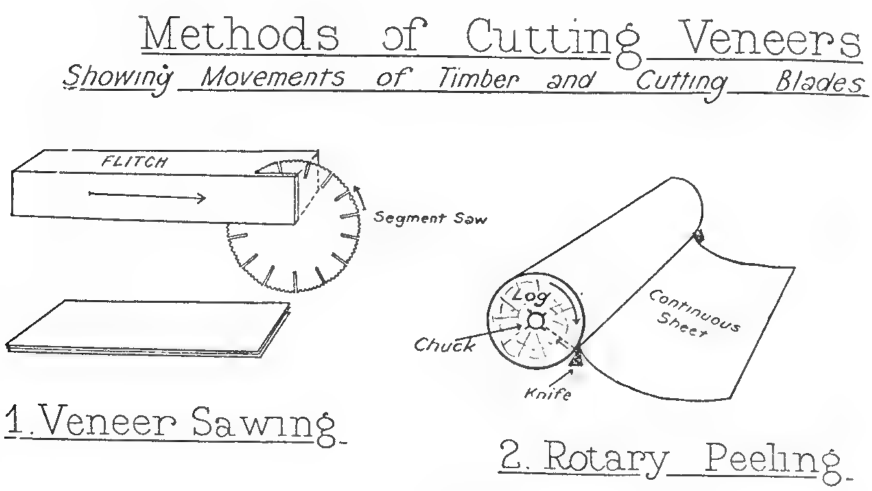

PLATE 67.

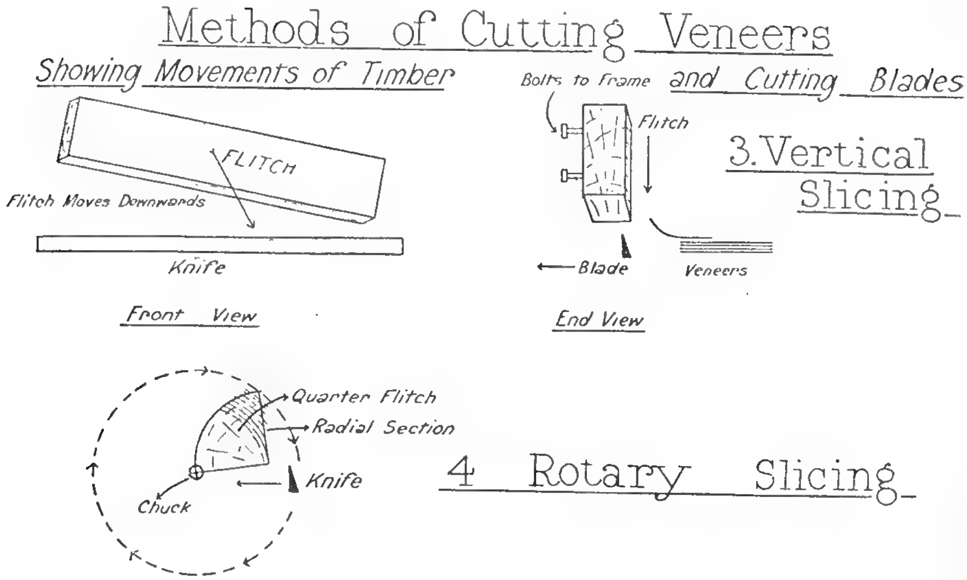

PLATE 68.

OTHER QUEENSLAND VENEER WOODS.

Amongst the Queensland timbers suitable for standard and fancy veneers and available in more or less limited quantities are the following:—

SILVER ASH (*Flindersia pubescens*).—A pleasing white, easily worked timber of the Maple Silkwood type in weight and texture and capable of being stained readily to any shade required. This wood makes a very high-grade plywood, and has at times a very pleasing figure. Rotary peeling gives the best effects. Logs are available from North Queensland.

SATIN SYCAMORE (*Ceratopetalum virchowii*) is similar in texture and working qualities to the Coachwood (*Ceratopetalum apetalum*) of New South Wales, but has a much more attractive figure. Rotary-cut veneer is well suited for interior decorative panelling. This wood grows only in the Atherton district in North Queensland.

ROSE ALDER (*Ackama quadrivalvis*).—This is a similar type to Satin Sycamore and grows in the same areas. It is, however, normally unfigured and presents a uniform bright-pink colour. It makes good rotary plywood.

ROSE WALNUT (*Cryptocarya erythroxylon*) is a native of Southern Queensland scrubs, and is available in large logs in moderate quantities. The plywood is pale-pink in colour with pleasing variations in shading. It is very strong and durable, and makes attractive wall panelling.

BLACK BEAN (*Castanospermum australe*) is sometimes veneered for overlaying furniture and for special panels. It cuts cleanly, and is often available in highly-figured wood, but the irregular shape of the trees makes the average returns of veneer rather low. The best logs are obtained in the Atherton district. The solid wood is often used for carving because of its mellow nature.

PLATE 69.—LOGS AWAITING PEELING AT A COUNTRY PLYWOOD FACTORY.

PLATE 70.—ROTARY LATHE IN OPERATION.

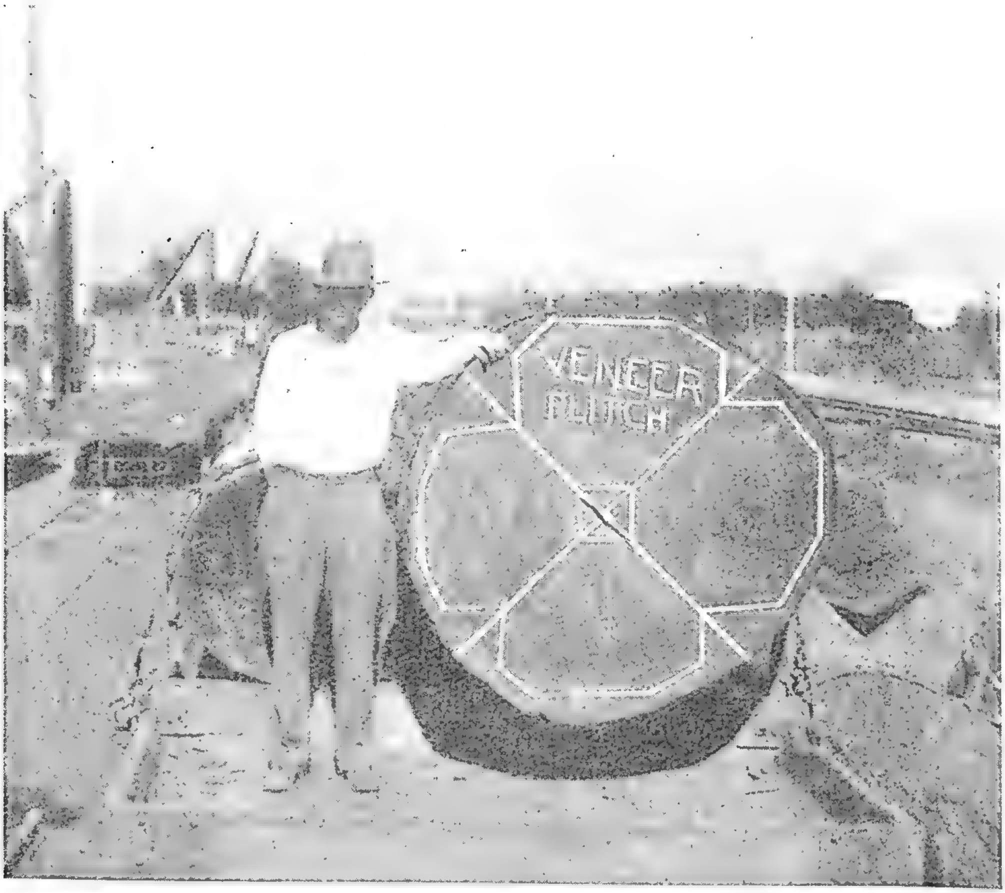

PLATE 71.—QUEENSLAND WALNUT LOG MARKED FOR SAWING INTO FLITCHES FOR QUARTER-SLICING.

NAMES OF QUEENSLAND VENEER WOODS.

Official Name.	Botanical Name.	Other Vernaculars.
Black Bean	*Castanospermum australe*	Beantree
Bunya Pine	*Araucaria bidwillii*	..
Canary Sassafras	*Doryphora sassafras*	Sassafras
Candlenut Siris	*Aleurites moluccana*	Candlenut
Hoop Pine	*Araucaria cunninghamii*	..
Ivorywood	*Siphonodon australe*	..
Kauri Pine	*Agathis palmerstoni*	..
Maple Silkwood	*Flindersia brayleyana*	Maple, Red Beech
	Flindersia pimenteliana	Silkwood
Queensland Satinay	*Syncarpia hillii*	..
Queensland Walnut	*Endiandra palmerstoni*	Walnut Bean, Black Walnut, Oriental Wood, Australian Laurel
Red Cedar	*Cedrela australis*	Cedar
Red Silkwood	*Lucuma galactoxyla*	Cairns Pencil Cedar
Red Siris	*Albizzia toona*	Acacia Cedar
Red Tulip Oak	*Tarrietia argyrodendron* var. *peralata*	Red Crowsfoot Elm
Rose Alder	*Ackama quadrivalvis*	Feathertop, Pencil Cedar
Rose Walnut	*Cryptocarya erythroxylon*	Pigeonberry Ash
Satin Sycamore	*Ceratopetalum virchowii*	Blood-in-the-bark
Silky Oak	*Cardwellia sublimis*	Bull Oak
Silver Ash	*Flindersia pubescens*	Ash
	Flindersia schottiana	Bumpy Ash
Silver Quandong	*Elæocarpus grandis*	Quandong
Tulip Cedar	*Melia azedarach*	White Cedar
Tulip Plum	*Pleiogynium solandri*	Burdekin Plum
White Aspen	*Pleiococca wilcoxiana*	Snowwood
White Hazelwood	*Symplocos spicata*	..
Yellow Cheesewood	*Sarcocephalus cordatus*	Leichhardt Tree
Yellowwood Ash	*Flindersia oxleyana*	..

ARE SOWS BETTER BACONERS THAN BARROWS?

A question that often crops up in the judging of pork and bacon pigs at agricultural shows is as to whether the sow will make up into better bacon than a barrow. The answer to such a question takes into consideration two phases. Sow pigs, particularly in warm climates, come in season very early, and one often notices sows awaiting slaughter that show distinct evidence of the oestral period (or of being on heat or in season). If slaughtered while in the feverish condition that accompanies the oestral period the meat will not set well nor will it be as good as is desirable in the finished form.

On the other hand, sow pigs produce a larger proportion of first-grade bacon, lean meat, than barrows, for sows are lighter in back fat and are thicker in the streak of lean meat running along the sides than is the case with males; on the other hand, there is less risk with barrow pigs, although it must be remembered that improper castration often results in the formation of deep-seated abscesses in the area of the scrotal sac, and many a good pen of barrow baconers has suffered at the hands of the judge who is discriminating and takes special care to examine that portion of the body referred to before giving his decision. Perhaps, after all, sow pigs do make the best bacon, but on the average so much depends on breeding, type, feeding, and handling that the matter of sex is virtually an unimportant one, and further the farmer has no control over the sex of his pigs so must make the best use possible of both boars and sows.

THE DAIRY INDUSTRY.

Supplied by the DAIRY BRANCH.

BREEDING.

Need for Better Cows.

The industry needs better cows, and the dairy farmers and breeders must breed and rear the better cows because they do not exist to the extent required at present. A great deal has been written on breeding. Practical breeders and scientific minds in collaboration have prepared sufficient data to enable the application of general principles to breeding, which if adopted by dairy farmers will lead to considerable improvement in their herd yields.

Mendel and His Theory.

The first to conclusively draw attention to the fact that there was a definite law of averages operating in respect to the transmission of characteristics from parents to progeny was Gregor Mendel. He was born in the year 1822, and was admitted to the King's Cloister, at Brünn, to be trained as a teacher. He was ordained a priest in 1847, went to Vienna from 1851 to 1853 to study mathematics, physics, and the natural sciences. He returned to the King's Cloister, of which, in 1868, he became prelate. In the Cloister garden at Brünn Mendel became an experimental plantgrower, and turned his attention to hybrids and hybridisation to discover the law governing reproductive behaviour.

It had been previously noted from breeding experiments with hybrids that among their descendants the hybrid kinds decreased while the pure kinds increased, but, so far, nobody had made a systematic classification and count of the whole of any hybrid's descendants through several generations. This Mendel set out to do and selected the ordinary edible pea as a suitable plant to use for the purpose.

Occurrence of Hybrids.

The result of Mendel's experiments was to show that hybrids do not breed erratically, as had been believed hitherto, but with extraordinary regularity. Since the finding of Mendel's papers in 1900 a considerable amount of scientific investigation has been made into what was known as the "Mendelian Theory," all of which has confirmed the extraordinary law of average operating in regard to the inheritance of characteristics.

In a previous article brief reference was made to the transmission of characteristics from the sire and dam to the progeny, and the terms "dominant" and "recessive" were used to distinguish between factors or characters which were apparent and those which were hidden or had seemingly disappeared. In the case where neither factor is dominant, however, we have an admixture between the two factors.

Law of Inheritance.

The following illustration of colour inheritance will indicate clearly the law which operates. Red crossed with red produces all red. White crossed with white produces all white. Red crossed with white produces all roan.

It will be observed that red and white are the true breeding colours and that roan is an admixture or cross of the red and white. Roan is therefore a hybrid, and when crossed with another roan should produce on the Mendelian average one pure red and one pure white to every two roans.

Roan crossed with red produces equal numbers of roans and reds, while the roan and white cross produces equal numbers of roans and whites.

The Sex Problem.

It will be evident to all that throughout the animal kingdom the most common character difference is that of sex. Careful research has shown that in many animals the male forms two types of germ-cells—namely, a male-determining cell and female-determining cell, which are formed in equal numbers. All animals do not follow this rule, however. In fowls, for instance, the position is reversed.

The calf is developed by the union of a male cell with a female cell, both of which contain the characteristics of the parents. Thus each joint cell, or the embryo calf, contains two sets of characteristics, one from each parent.

It will be evident from the foregoing that either of the individual factors in these sets of characteristics may be dominant while the other will be recessive, except where neither the male nor female factor is dominant, when the result will be an admixture of the two.

Inheritance from Sire and Dam.

Investigations have indicated that both parents contribute on the whole an equal number of characters to the offspring. It may happen, however, that the factors transmitted by the sire are dominant, and thus give the appearance of a greater inheritance from the sire. This actually does happen in the case of pure-bred bulls, which generally possess more dominant factors than the cows to which they are frequently mated.

Inbreeding, Line-breeding, and Outbreeding.

Modern investigations shed much light on the significance of these breeding practices, and indicate their value in breed improvement work, and at the same time their limitations.

Inbreeding.

In its broadest sense this term implies breeding between related individuals. As there are degrees of relationship, so there are degrees of inbreeding. If the animals are very closely related it constitutes intensive inbreeding, but if the animals are more distantly related the practice may be regarded as line-breeding.

The experience of all leading breeders shows that a considerable measure of inbreeding is necessary if uniformity in type or characteristics is to be attained. This is no new discovery, but was recognised by one of the earliest breeders—Robert Bakewell, who was born in Leicestershire in 1726 and died there in 1795.

Bakewell's Method.

The name of Robert Bakewell is famous, and reference is made to him in nearly all works on breeding. It is interesting to note his procedure in breeding. His chief successes were with cattle to produce beef and sheep to produce mutton.

About 1760, after travelling up and down the country to discover which were the best cattle to produce beef, he added to the stock already on his farm a bull from Westmoreland and several heifers from Warwickshire. The ordinary breeder would have sent this bull away when his eldest daughters were rising three and he was four or five years old, but because he could find no other bull to take his place Bakewell kept this bull till he was at least seven or eight years old and one of his sons was found fit to take his place. This son was also retained till one of his sons again was found fit to take his place.

This practice of selecting successive sires from his own stock was continued by Bakewell throughout his lifetime. A sire which left stock carrying the characters Bakewell desired them to carry was kept alive till a son was found which bred equally well or better. One of his sires was at least twelve or thirteen years old before being sent away. This meant that Bakewell's stock were very closely inbred.

Bakewell's method is perhaps more clearly indicated by his practice with sheep. When his flock, which, like his herd, started with the introduction of sheep from elsewhere, was established, other breeders wished to buy sires from him, but Bakewell would not sell sires; he would only let. Thus though the lambs they produced belonged to other breeders the sires still belonged to Bakewell, and those that bred the kind of stock Bakewell desired could be brought home again.

How many of our dairymen and breeders have wished that they could bring home again some sire whose worth was proved only after they had disposed of him? There is a lesson to be learnt in this story of Bakewell's practice.

Merits and Demerits of Inbreeding.

Many of the most noteworthy animals in the history of breeding have been the result of very close inbreeding, and this fact in itself should be sufficient to show that there is considerable merit in the practice. It has long been recognised that high-class inbred animals are prepotent. Unfortunately, closely inbred matings are just as likely to accentuate defects.

This tendency is, of course, very frequently seen in the human race, when certain heritable defects, such as feeble-mindedness, if present in a family, tend to show up following marriage within that family.

The question then arises: Is inbreeding harmful in itself? There is abundance of scientific evidence to show that it is not necessarily harmful, and, moreover, there is also plenty of practical evidence from our leading breeders. Experiments have been carried out in which rats have been bred under a system of brother to sister matings for twenty-five generations, and though in some strains there was deterioration, yet in certain selected ones no reduction in vigour, size, or fertility resulted.

The evidence shows that inbreeding tends to promote uniformity in characteristics. However, without rigid selection it will, as previously mentioned, accentuate harmful factors.

The stock that maintains its desirable characters under a system of inbreeding can be considered to have gained in value, for it would in consequence breed uniformly.

However, it must be stated that intensive inbreeding is a tool which should only be used in the hands of the big, skilled breeder who is prepared to cull drastically. The small breeder cannot afford to do much culling, and consequently should not be encouraged to conduct intensive inbreeding.

Line-breeding.

Line-breeding is a moderate form of inbreeding. It promotes a concentration of factors from related parents and thus tends to uniformity, though not necessarily to the same extent as inbreeding. It has the advantage of limiting also the accentuation of defects, and gives a considerable measure of control over heredity. It is a wise policy to follow in breeding, and it might be definitely said that, except where a strain does not possess the desirable breed characteristics, it is the only system which should be encouraged.

The following table is an example of line-breeding:—

LINE-BREEDING.

A therefore contains 25 per cent. of *I's* blood.
- $B = \frac{1}{4}$ of I
  - $D = \frac{1}{2}$ of I
    - I
  - E
- $C = \frac{1}{4}$ of I
  - $F = \frac{1}{4}$ of I
    - $H = \frac{1}{2}$ of I
      - I
    - J
  - $G = \frac{1}{4}$ of I
    - $K = \frac{1}{4}$ of I
      - $M = \frac{1}{2}$ of I
        - I
    - $L = \frac{1}{4}$ of I
      - $N = \frac{1}{2}$ of I
        - I

All animals shown in the pedigree except E and J carry a definite infusion of the blood of I. By this method desired individual characteristics of animals can be retained or even intensified in the progeny.

Outbreeding.

Outbreeding or outcrossing indicates a system of mating between animals of different strains or blood lines. Under such a system the variation in heritable factors must produce variation in the progeny. An outcross is only justified when it is desired to introduce some new combination of characters. Even then this should be followed by a renewed system of line-breeding, preferably to the blood of the favoured strain, and in this way the undesirable qualities of the original strain would be gradually eliminated.

Outbreeding often results in the production of very superior individuals. The progeny inherit the desirable dominant factors in both strains, but, being hybrids, their progeny breeds in the manner outlined in Mendel's experiments, and therefore as breeding animals they do not live up to their appearances.

Conclusion.

The subject of breeding is an extensive one. A prerequisite to the study of Mendelism is a good knowledge of mathematics. This article is therefore merely an elementary discourse on these subjects designed to interest dairy farmers in the laws which govern the inheritance of characteristics and by encouraging the adaptation of theory to practice lead to an improvement in breeding practices generally.

AGE AS A FACTOR IN BREEDING SOWS.

By E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

The question is frequently asked, "How long will a breeding sow continue in profit; or, at what age should a boar be culled out? At what age is a sow at her best; and is a six year old boar too far down the hill to be productive?" These questions are not readily answered, because so many factors have to be taken into consideration. First and foremost, pigs are kept solely because they are profit makers, and once they reach the stage where they are unprofitable they should be rigorously culled irrespective of all their other qualities.

Secondly, they are not of sufficient value individually to warrant consideration unless they can produce at a maximum profit. No animals should be kept on the farm merely for the sake of keeping them, and at best it is almost cruel to pension an animal off unless funds are available to enable that animal to be properly fed and cared for.

Experience has shown that the best age at which to commence a sow on her stud duties is between eight, or ten, or twelve months old. Sows are invariably ready to mate at ten months of age, some of the larger breeds are big enough at eight months, but should not be mated too young, as the breeding organs do not develop as rapidly as the framework. The boar is invariably ready to work at ten months, and in his case, too, he should not be used too young. The length of life at which they remain profitable varies considerably. Some sows and boars are in their prime at five years of age, others have ceased to be profitable at that age. However, if properly cared for and maintained in reasonable breeding condition, there is no reason why both boar and sow should not be good breeders up to the age of eight years, although in general very few breeders reach that age.

Overseas experiments have demonstrated that the best breeders are those that are properly developed before their stud duties begin. Sows are better breeders if they are continuous breeders—that is, if they have two litters per annum regularly and are not allowed to lose time between litters. The boar is a better and more reliable sire if he is regularly in service and is maintained in breeding condition only. Over-fatness, lack of exercise and unbalanced rations are both detrimental to the productive capacity of breeding stock. Sluggishness is induced and sterility or barrenness encouraged more by over-feeding and by a lazy life than by regularity of feeding and stud duties. The boar is capable of mating with fifty sows per annum; the sow is capable of producing twenty young pigs each year, and it should be the objective of the pig-raiser to obtain maximum results, and even if he is not able to provide sufficient work for the boar, he certainly can maintain his sows at full profit, and when they reach the stage that they are on the down grade, both male and female should be culled to make way for younger and more productive animals.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Jersey Cattle Society, the Australian Illawarra Shorthorn Society, and the Friesian Cattle Club, production charts for which were compiled for the month of December, 1933 (273 days period unless otherwise stated):—

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
JERSEY.				
Mature Cow (over 5 Years), Standard 350 Lb.				
Norwood of Fernlea	Kittle Brothers, Glencagle	7,182·38	434·09	Oxford Palatine Butter Boy
Senior, 2 Years (over 2½ Years), Standard, 250 Lb.				
Oxford Carnation	E. Burton and Sons, Wanora	5,212·38	314·236	Oxford Silvius
Oxford Clara	P. A. Smith, Miriam Vale	5,582	282·941	Trinity Ambassador.
Greenstock Buttercup (365 days)	J. B. Keys, Gowrie Little Plains	8,650·79	505·733	Carnation Larks Baron
Junior, 2 Years (under 2½ Years), Standard, 230 Lb.				
Glenview Cowslip	F. P. Fowler and Sons, Coalstoun Lakes	4,782	304·722	Carlyle Larkspur 2nd Empire
Gunawah Opera Queen (251 days)	F. Maurer, Darra	5,558·28	301·869	Retford Prometheus
Golden Daffodil of Golden Hill	C. Klaus, Mundubbera	4,779	262·41	Hero of Golden Hill
AUSTRALIAN ILLAWARRA SHORTHORNS.				
Senior, 3 Years (over 3½ Years), Standard, 290 Lb.				
Alsia of Glengallon	R. Tweed Kandanga	8,168·8	329·478	Nobleman of Blacklands.
Junior, 2 Years (under 2½ Years), Standard, 230 Lb.				
Murrays Bridge Phyllis 3rd	Hemmings Brothers, Murrays Bridge	6,522·5	277·878	Valiant of Greyleigh
Murrays Bridge Ivy 2nd	Hemmings Brothers, Murrays Bridge	6,204	266·292	Valiant of Greyleigh
FRIESIAN.				
Senior, 2 Years (over 2½ Years), Standard, 250 Lb.				
Oaklands Nolly Rock (365 days)	W. Richters, Tingoora	13,781·26	519·601	Pied Rock

Answers to Correspondents.

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. Cyril T. White, F.L.S.

Prickly Poppy.

S.C. (Allora)—

The specimen is *Argemone mexicana*, the Prickly Poppy, also known as Mexican Poppy. The plant is gazetted as a noxious pest throughout the State. It has been established in Queensland for a number of years, and is reputed to be poisonous to stock. However, stock generally leave it entirely alone. The only cases of poisoning by it that have come under our notice have been where the plants have been cut, allowed to wilt, and the wilted and softened plants eaten by calves.

Christmas Bells.

Inquirer (Brisbane)—

The Christmas Bells are plants of the Lily family and belong to a genus called *Blandfordia*, which is confined to Australia, not being found in any other part of the world. Four species or different kinds are known. Three of these are found in the coastal swamps of the so-called "wallum" country of New South Wales and Queensland. The common species in Queensland is one of the largest of the genus, and is found in New South Wales as far south as Sydney. The fourth species occurs in Tasmania, ascending some of the mountains to a height of 4,000 feet.

The genus *Blandfordia* was named by Sir J. E. Smith, a famous English botanist, and first president of the Linnean Society of London, in compliment to George, Marquis of Blandford, and son of the second Duke of Marlborough.

The Australian *Blandfordias* were introduced into cultivation in England in the early part of the 19th century, and in an Encyclopædia of Plants, published by J. C. Loudon in 1829, they are described as "beautiful New Holland Liliaceous plants very rarely seen in English collections."

Bleeding Heart.

L.W. (Cairns)—

The specimen is *Homalanthus populifolius*, sometimes called Bleeding Heart owing to the fact that the leaves turn red with age. It has a wide distribution in Eastern Australia, from the Bulli district in New South Wales to the Atherton Tableland. It is sometimes called the Bulli Poison Bush, but stockowners on the Atherton Tableland have told us that they have fed the plant to stock during times of drought and found it to be quite a good fodder. It belongs to the family Euphorbiaceæ.

Wild Millet.

W.G.A. (Rockton)—

The specimen is *Echinochloa crus-galli*, commonly known as Wild Millet. It is a grass widely spread over the warmer regions of the world, and very variable in form and size. One form is a more or less common weed in cultivations in Queensland, particularly on the Darling Downs, and this seems to be the one you forward, but it is an annual grass and is quite a good fodder, being relished by all classes of stock. It is supposed to be one of the wild parents of such well known cultivated fodders as Japanese Millet and White Panicum.

Prickly Lettuce.

A.S. (Mount Larcom)—

The specimen is the Prickly Lettuce, *Lactuca scariola.* This plant is generally regarded as poisonous to stock, though it would only seem to be in exceptional circumstances that they eat it in sufficient quantity to cause trouble. Generally speaking, it is left untouched by them. The poisonous symptoms are said to be intoxication similar to that caused by poppy heads, narcotic effects being dominant.

Native Tobacco.

A.M.McL. (Springsure)—

Regarding your inquiry about *Nicotiana megalosiphon,* the Long-Flowered Native Tobacco, no feeding tests or chemical work have been carried out wtih this species. Dr. J. M. Petrie, working on what he termed *Nicotiana suaveolens,* found the plant to contain a large percentage of nicotine, and nicotine is among the most violent poisons known. Dr. Petrie estimated that there was enough nicotine contained in ½ lb. of the green plant to poison a sheep, but feeding tests carried out afterwards in New South Wales did not bear this out, though other feeding tests did.

Up till recent years all the Australian Nicotianas were known as *Nicotiana suaveolens,* the different forms being classed merely as varieties. These have mostly been raised to specific rank now. It is probable that their nicotine content varies. It probably varies also from district to district. All Nicotianas must be regarded as dangerous, and they are certainly not safe plants to have where children are running. If children did chew the plants I think they would be taken violently ill or death would ensue. Both leaves and flowers of other Solanaceous plants have been known to kill children, such plants, for instance, as Cork Wood, *Duboisia myoporoides,* and the Stramonium, *Datura stramonium.*

Maltese Cockspur.

T.A.C. (Chinchilla)—

The specimen is the Maltese Cockspur, *Centaurea melitensis.* This is an objectionable weed in the southern and the cooler parts of the State. If it has appeared on your property on an extensive scale you could try eradicating it by a chemical spray such as "Weedex." If only a few plants have established themselves they could be eradicated by hoeing out. In all cases it is preferable to deal with weeds of this type before they flower.

Broad-leaved Carpet Grass.

D.H. (Kuraby)—

The sample has been identified as the Broad-leaved Carpet Grass, *Axonopus compressus.* This grass has some value as a fodder on light soils or on second-grade country where the better pasture grasses will not flourish.

Bishop's Weed.

S.C. (Warwick)—

The specimen is *Ammi majus,* Bishop's Weed, a common European plant, grown a good deal in Australia under the name of Meadow Sweet. It is used extensively in the cut flower trade, but is not to be confused with the true Meadow Sweet of Britain. It has become naturalised in several localities, but so far as I know has not yet shown any tendency to become a noxious plant. It is very difficult to foretell the behaviour of these plants when once they begin to spread, but I do not think any fears should be entertained regarding the present specimen.

Caustic Creeper.

A.J.I. (Hodgson)—

Euphorbia Drummondii, Caustic Creeper.—In New South Wales this plant has been found to contain a prussic-acid-yielding glucoside, and when eaten in large quantities by travelling stock, particularly when hungry and on an empty stomach, a number of deaths may ensue. Repeated tests with the Queensland plant, however, have always given negative results, and the symptoms given certainly do not point to prussic-acid poisoning. The symptoms are that the head and neck swell to a large extent, and if the swelling is pierced an amber-coloured fluid runs out and the life of the sheep may be saved.

Capacity of Hayshed.

W.H.J. (Mount Larcom)—

A hayshed having dimensions 40 feet by 30 feet by 12 feet would hold approximately 32 tons of lucerne hay. A ton of lucerne hay would occupy approximately 450 cubic feet.

General Notes.

Staff Changes and Appointments.

Mr. J. W. Winlaw, Assistant Teacher of Manual Training Subjects, Rural School, Gayndah, has been appointed an Inspector under the Stock, Dairy, and Slaughtering Acts, Department of Agriculture and Stock.

Constable P. B. Guymer, Hungerford, has been appointed also an Inspector of Slaughter-houses.

The Officer of the Northern Territory Police stationed at Lake Nash has been appointed also an Acting Inspector of Stock, Queensland.

Mr. H. Bellert, junior, Fraser Island, has been appointed an Honorary Ranger under the Native Plants Protection Act.

Mr. E. J. R. Barke, Chemist in Charge, Sugar Experiment Station, South Johnstone, has been appointed Chemist in Charge, Sugar Experiment Station, Meringa.

Mr. F. G. Few, B.Sc., B.App.Sc. (Queensland), Assistant to Analyst, Agricultural Chemical Laboratory, Department of Agriculture and Stock, has been appointed Analyst, Agricultural Chemical Laboratory.

Mr. E. T. Lewin, Inspector of Stock, Julia Creek, and Mr. S. C. Allan, Inspector of Stock, Cloncurry, have been appointed also Inspectors of Slaughter-houses.

Animals and Birds Sanctuaries.

Whitsunday, Hook, and Gumbrell Islands have been declared sanctuaries for the protection of animals and birds by Order in Council issued 11th January, 1934. Other islands of the Group—namely, Hayman, the Double Cone, and Molle Groups—have already been declared sanctuaries under the Animals and Birds Acts.

Egg Board Election.

The election of a grower's representative for District No. 4 (Moreton) of the Egg Board resulted in the return of the retiring member, Mr. Alexander McLauchlan, Boonah, who received 117 votes as against 54 votes cast in favour of Mr. H. J. Jurgensen, Moogerah, via Kalbar. All of the other members of the Board—namely, Messrs. R. J. Corbett, A. A. Cousner, Tom Hallick, and W. T. Hughes—were returned unopposed. The new Board will be appointed for a term of one year as from the 1st January.

Honey Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts, giving notice of intention to extend the operations of the Honey Board from the 9th March, 1934, until the 8th March, 1939.

A petition signed by 10 per cent. of the growers of honey and beeswax may be lodged on or before the 5th February next requesting that a vote may be taken on the question of the continuance of the Pool until March, 1939.

Nominations are also being invited for the election of four representatives on the Honey Board for a period of two years as from 9th March, 1934.

Rural Topics.

When Washing the Milk Cans.

Boiling water is absolutely necessary in dairy work to ensure cleanliness, and there should be no sparing of it. It is well, however, not to start washing the utensils with water that is boiling, for this very high temperature has a tendency to cause the albumen to coagulate, and stick to the utensil in a thin, often invisible, film that supplies a breeding ground for bacteria. The utensils should first be washed with warm water, with a little washing soda or other alkali added, using good brushware (cloths being very objectionable), after which they should be scalded in ample boiling water, and then placed in a clean place to dry.

Green Feed for Poultry—Precautions against Poisoning.

The poisonous properties of many weeds, and even of some fodder plants at certain stages (or if eaten in excess), is well known among big stock owners, but it is not generally recognised to what extent poultry become victims to unsuitable and even poisonous green stuff.

Many thousands of poultry are lost and many more are made ill (with a consequent los of egg-production) as a result of eating weeds of various kinds. This is nearly always brought about by circumstances and environment. For instance, a shortage of suitable green feed will cause the birds to eat many weeds that they would not otherwise touch. This particularly applies to birds kept in bare yards or confined to houses. If let out such birds will eat almost anything green. Naturally they will eat suitable fodders if available, but if not they will often eat unsuitable ones.

Obviously, too, if such birds are let out of bare yards on to a perfectly good class of green food they will eat to excess, and trouble in the form of digestive disorder will often ensue. How much more serious then may the trouble become if there are present one or more injurious plants instead of good edible fodder plants or grass. Birds roaming on free range will rarely eat poisonous weeds or any fodder in excess.

Another way in which poultry farmers encounter this trouble is in the green feed supplied to the pens. Take, for example, the farmer who is growing such crops as lucerne for green feed, cutting and feeding it to the birds in yards divested of any edible green feed whatever. Many cases came under notice where birds are dying or are falling off in production, where the cause is found to be some weed or unsuitable green feed that is being unsuspectingly fed with the other fodder, the farmer being under the impression that the birds will pick out only the suitable stuff. As a matter of fact, that is what would occur if there was sufficient of the good fodder, but in most such cases there is not, and hence the trouble.

Another source of trouble in connection with growing green feed for poultry is that it is often cut and fed at a stage when it has become too fibrous, and even contains some dead matter, such as dead flag of barley, &c. The trouble in this connection arises not so much from the excessive fibre content, but from the fact that such dead matter often forms itself into balls and prevents the passage of the other food from the crop to the gizzard, the only portion of the anatomy of the bird that can deal with it. The result of this stoppage is what is known as "sour crop," a condition that arises from fermentation of the food that is held back long after it should have passed on to the gizzard.

It will be seen how necessary it is for the poultry farmer to be ever on the alert to prevent these happenings, remembering always that if birds are kept short of their requirements in the way of succulent green feed, they are likely to eat too much when let out on to pasture of any kind. In cases where birds have been so kept, and it is desired to let them out of bare yards on to a growth of vegetation of any kind (even grass, if succulent) it is best to let them on to it for only half an hour to an hour at a time, gradually lengthening the period each day for a few days before allowing full access to the new run.—A. and P. Notes, N.S.W. Dept. Agric.

Molasses for Pigs.

The College of Agriculture, University of the Philippines, has recently carried out experiments on thirty-five pigs over a period of seven months to determine and compare the feeding value of molasses and corn as basal feed for growing pigs and sows for breeding purposes.

(1) In the mixture of feeds used in these experiments for growing pigs and young breeding sows, one part of molasses was equal to one part of corn in feeding value.

(2) Molasses can be substituted in part for corn when corn becomes scarce and expensive.

(3) To prepare an animal for show purposes molasses appears to be a very useful feed, as it imparts a smoothness and refinement to the general appearance of the animal, and has a beneficial effect on the digestive organs.

(4) Molasses is an appetiser, a conditioner, and a useful addition to feeding stuffs for pigs, but must not be fed in excess, or as a sole food, otherwise results will be unsatisfactory.

Fecundity Records in Pigs.

That fecundity is an hereditary factor in pig breeding is now generally recognised. The wise man buying a boar or a sow wants to know the farrowing records of the ancestors before he buys. When fecundity records were first introduced in Great Britain their usefulness and accuracy were not always accepted, but when the summaries of each year's records began to appear and pedigrees became something more than names, doubts disappeared.

Fecundity records and their development in the form of an advanced Register of Sows that have achieved a minimum standard of eight pigs reared in four consecutive litters within twenty-six months afford interesting evidence of the value of the collection and collation of records from the herds of breeders.

A typical illustration of the value of these records is noted on the pedigree and record of a well-known boar in England. The fecundity record of this animal shows that he is one of a litter of 12 born, 12 reared, that his sire was also from a litter of 12 born, 12 reared, and that his dam was from a litter of 11, all of which were reared.

With a record such as this, backed up by individual excellence of the ancestors and the boar himself, one would be quite justified in looking for even better results in the progeny of such an animal.

Railing Pigs in Crates in Queensland.

When stud pig breeders are railing pigs in crates from one station to another, they should remember that in order to discourage the use of cumbersome crates which are too large for a railway guard to safely unload at roadside stations, provision has been made in the railway goods By-laws for the rate for a half wagon to apply when the weight of a crate containing more than one animal exceeds 2 cwt.

Where two animals are to be forwarded and the total weight of pigs and crate exceeds 2 cwt., it is cheaper and better to forward in two crates.

Pig crates should be of a size to comfortably accommodate the animal, not too large or too small, and they should be made of soft wood and not of heavy ironbark boards. Details of crate measurements and other information pertaining thereto can always be obtained from the Department of Agriculture and Stock, Brisbane.

Lucerne as a Food for Pigs.

As a result of experiments in the use of lucerne as a food for pigs and to determine its effect on the quality of bacon and ham, Mr. G. E. J. Chaseling, of Coolabunia, Queensland, advises caution against fattening pigs on lucerne or allowing them to run on lucerne while they are being finished for market. Lucerne, he considers, is most excellent grazing for growing pigs, but they should be kept off it for at least six weeks before going to market. He refers to the "feedy flavour" given to milk by lucerne, and states it gives the same undesirable odour to pork, and lucerne-fed bacon takes on an ugly rusty appearance after being cured, which is most undesirable.

A Fair Question.

"What would a dairyman do to an orchardist who owned a diseased bull and allowed it to roam the district, or to the orchardist who sold milk and butter without being registered?" Mr. K. D. McGillivray, of Moorland, put this poser to delegates to the recent North Coast Agricultural Bureau Conference at Taree (N.S.W.), and answering the query himself he said that the law amply protected dairymen against such inconsiderate orchardists. "But what can the orchardist do to a dairy farmer whose neglected fruit trees are breeding and spreading pests and diseases, or to the dairy farmer who is unloading his surplus fruit on to a local market regardless of what price he gets for it?" continued Mr. McGillivray.

The law did not give orchardists as much protection as it gave dairymen, at least insofar as protecting them from unfair competition by those not legitimately engaged in the fruitgrowing industry. Mr. McGillivray considered that this state of affairs was due to the fruitgrowers not being as well organised as the dairy farmers. The orchardist did not want to deprive the farmer of the right to sell his surplus fruit, but he did think that farmers should not jeopardise the livelihood of commercial orchardists by allowing their neglected trees to become veritable breeding grounds for pests and diseases. Furthermore, he suggested that rather than sell their surplus fruit at any old price, they should ask a fair market value, the idea being not to depress prices, to the detriment of the commercial fruitgrower.

Cauliflower Cultivation.

Care in seed-bed work—more than is generally exercised—is essential if the growing of cauliflower (seed of which is usually sown from December to the early autumn months) is to give satisfactory returns.

It is very common to find growers using the same soil year after year for seed-beds because it is situated close to the water-tap. It has been proved that this procedure is responsible for the rapid spread of many of the most serious diseases. Again, insufficient attention is given to the preparation of the soil in the beds. To obtain the best results the beds should be prepared some weeks before sowing and given a liberal dressing of organic manure, which should be dug in and allowed to decay. A good practice is to give the bed a dressing of lime a few weeks before the soil is finally finished off for seeding. If artificial fertilizer is to be used in the seed-beds it should be in the form of superphosphate alone.

The seed should be planted in rows, at least 4 inches apart, made across the beds. This practice allows the seedlings sufficient room for development and also facilitates weeding. The seedlings are ready for transplanting to the field about two months after seeding.

Animal Health Station—A Grazier's Tribute.

Thus "An Old Timer" in a letter to the Editor of the "Courier-Mail" (29th December, 1933):—That article which you published in the "Courier-Mail" on Thursday about the work of the Animal Health Station at Yeerongpilly brought forcibly to my mind the splendid work that has been achieved in the last thirty years. My earliest memory of Queensland goes back to a most unfortunate incident of many years ago. My father made a "fine deal" for some Queensland bullocks. I can remember the day they arrived; great shaggy, long-horned, wild-eyed animals that appeared to be shivering with the cold blast that blew across the plains near Goulburn, in New South Wales. Within a week most of them were "down" with pleuro-pneumonia, and the disease took a terrible toll of them and of the rest of our cattle. At that time cattle were subjected also to anthrax, black-leg, and other deadly diseases. Years later, then in North Queensland, I had an experience—and a sad one, too—from redwater, a disease that brought ruination to many pastoralists. Nowadays we seldom hear anything of serious diseases in cattle.

I lift my hat, figuratively, to the veterinary surgeons who have captured and banished many of the dreadful stock diseases against which earlier breeders had to fight. Science has made wonderful strides in fighting the battle for the man on the land; it may have a long way still to go, and there might be a very vast field for it to clear up, but those whose memories can go back to the 'nineties and early nineteen hundreds will agree that a wonderful lot has been accomplished. Here's the best to the Animal Health Station at Yeerongpilly and all connected with it.

Big Cows or Little Cows?

Experiments conducted in America show that, so far as any definite statement can be made on the subject, the big dairy cow is more profitable than her smaller sister.

As a rule, large cows are better than the small ones for the production of milk and butter-fat. They also produce a higher income over food cost, in spite of the fact that they consume more roughage. The reason is that the larger animals require less food for maintenance per hundred pounds live weight. The energy expended in maintaining a living body can be measured in the heat radiated from that body. Radiation is in proportion to surface. The smaller animal has the greater surface in proportion to its weight, and consequently there is a greater radiation of heat from its body, and a greater consumption of food to supply energy.

Another reason why, for dairy purposes, a large animal is better than a small one is that the greater body space affords more room for the complicated "machinery" that is necessary to manufacture milk from food. Too often it is forgotten that milk is only made from food consumed. The amount of work performed by the heart and lungs of a heavy milking cow is enormous, so that any contraction in the region of the chest or any failure to pump an adequate blood supply through and around the udder, militates against big production.

In discussing the relative merits of the large and the small cow, the dual-purpose cow often confuses the issue. If an undue proportion of the food consumed is used for the manufacture of beef, the quantity available for milk production is proportionately reduced.

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of unnecessary deaths.

HEALTH TALKS.

EVERY year about 6,000 children hear health talks given by the nurses of the Infant Welfare Railway Car. Sometimes they are asked to write little essays to show what they have learnt from these talks. Lately we have been shown some of these essays, which have pleased us so much that we are printing two of them. We have left out some sentences, but have made no alterations. We should like to explain that we do not ask children to drink no tea until they are twenty-one. We think that children under school age should drink no tea at all. They can be quite happy with milk and lemon drinks. If older children drink tea, it should be half milk. We hope that long before they are twenty-one they will have learnt to like tea that is not too strong and has plenty of milk in it.

The first essay is by a little girl of eight years. "There are three things we need to live—fresh air, fresh water, and food. We should sleep on a veranda or in a room with the doors and windows wide open. The best time to have a drink is to have it when we get out of bed in the morning, and we should have a bath then, too. We must eat foods that contain vitamins, such as all green vegetables, tomatoes, milk, eggs, nuts, cod liver oil, wholemeal, carrots, and fresh fruits. Arrowroot biscuits and soft, sweet, sticky toffee should not be eaten because they stick round the teeth, and a toothbrush will not get all out and so it decays the teeth. Children should not drink tea before they are twenty-one because it dries up the saliva in their mouths and then they have nothing to help them digest their food. And they do not need it because it is a drug and a stimulant."

The second essay is by a girl of twelve years. "The most essential way to keep healthy is to see that we have sufficient fresh air. We should sleep on the veranda if possible, and, if not, in a room which has the doors and windows wide open. The next essential to health is fresh water. We should drink plenty of water on rising in the morning. Plenty of fresh water should be used in having a daily bath. Also, there are the right kinds of foods. Every child should drink fresh cow's milk and eat wholemeal bread, green vegetables, tomatoes, butter, cheese, and eggs. By wholemeal bread is meant bread made with pure wholemeal flour, not bread darkened with syrup. Every mother should buy wholemeal flour for her children, as it can be used for making bread, scones, pastry, &c. Milk should be drunk at all meals, and water between meals. If mother gives us fruit for lunch we should eat it last, as it cleans our teeth and we cannot carry our toothbrushes to school. A sign with "Bad teeth sold here" should be pasted across all confectioners' shops so that children will realise what they are buying. Boiled lollies and barley sugar are the only sweets to be eaten by children."

Though we may not agree with every word, we think these essays prove that children are interested in health talks, remember what they hear, and can write it down afterwards. Education is a preparation for life, and good health is one of the most important things in life. Is it not strange that children are taught so little about health while at school? These children hear a lecture on health only once a year, but the children in Brisbane and other towns never hear any such lecture at all. Can they be really educated when they have not learnt the simplest rules for keeping in good health? We hope all school teachers and education authorities will put on their thinking caps and consider what can be done about this.

Orchard Notes for March.

THE COASTAL DISTRICTS.

If the weather is favourable, all orchards, plantations, and vineyards should be cleaned up, and the ground brought into a good state of tilth so as to enable it to retain the necesary moisture for the proper development of trees or plants. As the wet season is frequently followed by dry autumn weather, this attention is important.

Banana plantations must be kept free from weeds, and suckering must be rigorously carried out, as there is no greater cause of injury to a banana plantation than neglect to cultivate. Good strong suckers will give good bunches of good fruit, whereas a lot of weedy overcrowded suckers will only give small bunches of undersized fruit that is hard to dispose of, even at a low price.

Cooler weather may tend to improve the carrying qualities of the fruit, but care must still be taken to see that it is not allowed to become over-developed before it is packed, otherwise it may arrive at its destination in an over-ripe and consequently unsaleable condition. The greatest care should be taken in grading and packing fruit. Only one size of fruit of even quality must be packed. Smaller or inferior fruit must never be packed with good large fruit, but must always be packed separately as required by regulation.

The marketing of the main crop of pineapples, both for canning and the fresh fruit trade, will be completed in the course of the month, and as soon as the fruit is disposed of plantations, which are apt to become somewhat dirty during the gathering of the crop, must be cleaned up. All weeds must be destroyed, and if blady grass has got hold anywhere it must be eradicated, even though a number of pineapple plants have to be sacrificed, for once a plantation becomes infested with this weed it takes possesion and soon kills the crop. In addition to destroying all weed growth, the land should be well worked and brought into a state of thorough tilth.

In the Central and Northern districts, early varieties of the main crop of citrus fruits will ripen towards the end of the month. They will not be fully coloured, but they can be marketed as soon as they have developed sufficient sugar to be palatable; they should not be gathered whilst still sour and green. Citrus fruits of all kinds require the most careful handling, as a bruised fruit is a spoilt fruit, and is very liable to speck or rot. The fungus that causes specking cannot injure any fruit unless the skin is first injured. Fruit with perfect skin will eventually shrivel, but will not speck. Specking or blue mould can therefore be guarded against by the exercise of great care in handling and packing. At the same time, some fruit is always liable to become injured, either by mechanical means, such as thorn pricks, wind action, hail, punctures by sucking insects, fruit flies, the spotted peach moth, or gnawing insects injuring the skin. Any one of these injuries makes it easy for the spores of the fungus to enter the fruit and germinate. All such fruit must therefore be gathered and destroyed, and so minimise the risk of infection. When specked fruit is allowed to lie about in the orchard or to hang on the trees, or when it is left in the packing sheds, it is a constant source of danger, as millions of spores are produced by it. These spores are carried by the wind in every direction, and are ready to establish themselves whenever they come in contact with any fruit into which they can penetrate. Specking is accountable for a large percentage of loss frequently experienced in sending citrus fruits to the Southern States, especially early in the season, and as it can be largely prevented by the exercise of necessary care and attention, growers are urged not to neglect these important measures.

Fruit must be carefully graded for size and colour, and only one size of fruit of one quality should be packed in one case. The flat bushel-case (long packer) commonly used for citrus fruits does not lend itself to up-to-date methods of grading and packing, and we have yet to find a better case than the American orange case. Failing this case, a bushel-case suggested by the New South Wales Department of Agriculture is the most suitable for citrus fruits, and were it adopted it would be a simple matter to standardise the grades of our citrus fruit, as has been done in respect to apples packed in the standard bushel-case used generally for apples throughout the Commonwealth. The inside measurements of the case suggested are 18 in. long, 11¾ in. wide, and 10½ in. deep. This case has a capacity of 2,200 cubic inches, but is not included in the schedule of the regulations under "*The Fruit Cases Acts*, 1912-1922." The half-bushel case, No. 6 of the Schedule above referred to, is

10 in. by 11¾ in. by 5¼ in. inside measurements with a capacity of 1,100 cubic inches. The case should be suitable for oranges and the half-case of mandarins. No matter which case is used, the fruit must be sweated for seven days before it is sent to the Southern markets, in order to determine what fruit has been attacked by fruit fly, and also to enable bruised or injured fruit liable to speck to be removed prior to despatch.

Fruit fly must be fought systematically in all orchards, for if this important work is neglected there is always a very great risk of this pest causing serious loss to citrus growers.

The spotted peach moth frequently causes serious loss, especially in the case of navels. It can be treated in a similar manner to the codling moth of pip fruit, by spraying with arsenate of lead, but an even better remedy is not to grow any corn or other crop that harbours this pest in or near the orchard. Large sucking-moths also damage the ripening fruit. They are easily attracted by very ripe bananas or by a water-melon cut in pieces, and can be caught or destroyed by a flare or torch when feeding on these trap fruits. If this method of destruction is followed up for a few nights, the moth will soon be thinned out.

Strawberry planting may be continued during the month, and the advice given in last month's notes still holds good. Remember that no crop gives a better return for extra care and attention in the preparation of the land and for generous manuring than the strawberry.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

THE advice given in these notes for the last few months regarding the handling, grading, and packing of fruit should still be followed carefully. The later varieties of apples and other fruits are much better keepers than earlier-ripening sorts, and as they can be sent to comparatively distant markets, the necessity for very careful grading and packing is, if anything, greater than it is in the case of fruit sent to nearby markets for immediate consumption. Instruction in the most up-to-date methods of grading and packing fruit has been published by the Department, which advice and instruction should enable the growers in that district to market their produce in a much more attractive form.

The same care is necessary in the packing of grapes. Those who are not expert cannot do better than follow the methods of the most successful packers.

As soon as the crop of fruit has been disposed of, the orchard should be cleaned up, and the land worked. If this is done, many of the fruit-fly pupæ that are in the soil will be exposed to destruction in large numbers by birds, or by ants and other insects. If the ground is not worked and is covered with weed growth, there is little chance of the pupæ being destroyed.

Where citrus trees show signs of the want of water, they should be given an irrigation during the month, but if the fruit is well developed and approaching the ripening stage, it is not advisable to do more than keep the ground in a thorough state of tilth, unless the trees are suffering badly, as too much moisture is apt to produce a large, puffy fruit of poor quality and a bad shipper. A light watering is therefore all that is necessary in this case, especially if the orchard has been given the attention recommended in these notes from month to month.

Farm Notes for March.

LAND on which it is intended to plant winter cereals should be in a forward stage of preparation. Sowings of lucerne may be made at the latter end of the month on land which is free from weed growth and has been previously well prepared.

The March-April planting season has much in its favour, not the least of which is that weeds will not make such vigorous growth during the succeeding few months, and, as a consequence, the young lucerne plants will have an excellent opportunity of becoming well established.

Potato crops should be showing above ground, and should be well cultivated to keep the surface soil in good condition; also to destroy any weed growth.

In districts where blight has previously existed, or where there is the slightest possible chance of its appearing, preventive methods should be adopted—i.e., spraying with "Burgundy mixture"—when the plants are a few inches high and have formed the leaves; to be followed by a second, and, if necessary, a third spraying before the flowering stage is reached.

Maize crops which have fully ripened should be picked as soon as possible and the ears stored in well-ventilated corn cribs, or barns. Selected grain which is intended for future seed supplies should be well fumigated for twenty-four hours and subsequently aerated and stored in airtight containers. Weevils are usually very prevalent in the field at this time of the year and do considerable damage to the grain when in the husk.

The following crops for pig feed may be sown:—Mangel, sugar beet, turnips and swedes, rape, field cabbage, and carrots. Owing to the small nature of the seeds, the land should be worked up to a fine tilth before planting, and should contain ample moisture in the surface soil to ensure a good germination. Particular attention should be paid to all weed growth during the early stages of growth of the young plants.

As regular supplies of succulent fodder are essentials of success in dairying operations, consideration should be given to a definite cropping system throughout the autumn and winter, and to the preparation and manuring of the land well in advance of the periods allotted for the successive sowings of seed.

The early-planted cotton crops should be now ready for picking. This should not be done while there is any moisture on the bolls, either from showers or dew. Packed cotton showing any trace of dampness should be exposed to the sun for a few hours on tarpaulins, bags, or hessian sheets, before storage in bulk or bagging or baling for ginning. Sowings of prairie grass and *Phalaris bulbosa* (Toowoomba canary grass) may be made this month. Both are excellent winter grasses. Prairie grass does particularly well on scrub soil.

Dairymen who have maize crops which show no promise of returning satisfactory yields of grain would be well advised to convert these into ensilage to be used for winter feed. This, especially when fed in conjunction with lucerne or cowpea, is a valuable fodder. Where crops of Soudan grass, sorghum, white panicum, Japanese millet, and liberty millet have reached a suitable stage for converting into ensilage, it will be found that this method of conserving them has much to recommend it. Stacking with a framework of poles, and well weighting the fodder, is necessary for best results. All stacks should be protected from rain by topping off with a good covering of bush hay built to a full eave and held in position by means of weighted wires.

TO SUBSCRIBERS—IMPORTANT.

Several subscriptions have been received recently under cover of unsigned letters. Obviously, in the circumstances, it is impossible to send the Journal to the subscribers concerned.

It is most important that every subscriber's name and address should be written plainly, preferably in block letters, in order to avoid mistakes in addresses and delay in despatch.

CLIMATOLOGICAL TABLE—DECEMBER, 1933.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature. Means. Max.	Means. Min.	Extremes. Max.	Date.	Min.	Date.	Rainfall. Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·76	87	73	91	28	67	18	623	13
Herberton	..	82	65	92	30	54	12	443	14
Rockhampton	29·85	87	70	96	14	64	30	400	12
Brisbane	29·93	82	67	88	15	63	20	520	19
Darling Downs.									
Dalby	29·90	84	62	93	13	55	16, 30	224	8
Stanthorpe	..	76	57	85	8, 13	47	16	514	17
Toowoomba	..	78	59	85	13, 14	52	30	443	19
Mid-interior.									
Georgetown	29·80	93	71	99	4, 24	68	3	616	11
Longreach	29·80	94	70	102	23	59	18	321	5
Mitchell	29·87	86	62	94	31	50	18	234	8
Western.									
Burketown	29·77	94	77	105	28	70	15, 16	484	8
Boulia	29·78	99	74	107	5, 6, 25, 31	63	17, 18	23	2
Thargomindah	29·84	91	70	102		61	15, 16	229	4

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF DECEMBER, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING DECEMBER, 1933, AND 1932, FOR COMPARISON.

Divisions and Stations.	Average Rainfall. Dec.,	No. of Years' Records.	Total Rainfall. Dec., 1933.	Dec., 1932.
North Coast.	In.		In.	In.
Atherton	7·60	32	7·60	9·62
Cairns	9·06	51	7·65	15·49
Cardwell	8·22	61	22·33	9·17
Cooktown	6·84	57	6·23	9·23
Herberton	5·90	47	4·43	7·17
Ingham	6·93	41	18·50	11·43
Innisfail	12·07	52	18·92	27·01
Mossman Mill ..	11·22	20	11·89	14·84
Townsville	5·55	62	11·41	8·63
Central Coast.				
Ayr	4·14	46	2·38	4·80
Bowen	4·49	62	3·73	3·53
Charters Towers ..	3·41	51	1·77	3·09
Mackay	7·29	62	5·75	11·37
Proserpine	8·23	30	4·81	8·35
St. Lawrence ..	4·84	62	3·41	9·70
South Coast.				
Biggenden	4·53	34	6·74	2·39
Bundaberg	4·98	50	9·48	2·68
Brisbane	4·89	82	5·20	2·49
Caboolture	5·14	46	12·39	1·31
Childers	5·57	38	9·96	4·24
Crohamhurst.. ..	6·92	40	16·24	1·82
Esk	4·69	46	5·56	2·49
Gayndah	4·17	62	2·87	2·09
Gympie	5·99	63	9·24	2·67
Kilkivan	4·47	54	6·72	2·21
Maryborough ..	4·75	61	9·67	4·25
Nambour	6·78	37	13·71	3·14
Nanango	3·82	51	4·21	3·83
Rockhampton ..	4·87	62	4·00	9·54
Woodford	5·57	46	11·15	3·54

Divisions and Stations.	Average Rainfall. Dec.,	No. of Years' Records.	Total Rainfall. Dec., 1933.	Dec., 1932.
Central Highlands.	In.		In.	In.
Clermont	3·96	62	1·97	1·75
Gindie	2·90	34	0	1·53
Springsure	3·27	64	0·86	1·80
Darling Downs.				
Dalby	3·25	63	2·24	4·77
Emu Vale	3·48	37	3·70	3·28
Hermitage	2·94	27	2·40	2·86
Jimbour	3·22	45	1·87	2·98
Miles	3·07	48	3·02	2·17
Stanthorpe	3·51	60	5·14	3·10
Toowoomba ..	4·42	61	4·43	3·69
Warwick	3·39	68	3·68	3·40
Maranoa.				
Roma	2·53	59	1·18	2·61
State Farms, &c.				
Bungeworgorai ..	3·02	19	0·92	1·88
Gatton College ..	3·63	34	4·48	1·46
Kairi	6·35	19	9·70	9·49
Mackay Sugar Experiment Station	8·49	36	5·72	8·03

GEORGE G. BOND, Divisional Meteorologist.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

MOONRISE.

	February. 1934.		March. 1934.		Feb. 1934.	Mar. 1934.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	5·24	6·46	5·45	6·25	7·40	6·11
2	5·25	6·45	5·46	6·24	8·10	6·41
2	5·26	6·44	5·46	6·22	8·38	7·11
4	5·27	6·44	5·47	6·21	9·9	7·42
5	5·28	6·43	5·48	6·20	9·41	8·18
6	5·29	6·43	5·48	6·19	10·15	8·58
7	5·30	6·42	5·49	6·18	10·57	9·44
8	5·30	6 42	5·49	6·17	11·47	10·38
9	5·31	6·41	5·50	6·16	..	11·39
					a.m.	a.m.
10	5·32	6·41	5·51	6·14	12·47	..
11	5·32	6·40	5·52	6·13	1·51	12·45
12	5·33	6·40	5·52	6·11	3·0	1·52
13	5·34	6·39	5·53	6·10	4·11	3·3
14	5·34	6·39	5·54	6·9	5·23	4·9
15	5·35	6·38	5·55	6·8	6·30	5·14
16	5·36	6·38	5·56	6·6	7·34	6·17
17	5·36	6·37	5·56	6·5	8·37	7·18
18	5·37	6·36	5·56	6·4	9·37	8·21
19	5·37	6·35	5·56	6·4	10·36	9·20
20	5·38	6·34	5·56	6·3	11·36	10·21
					p.m.	
21	5·38	6·33	5·56	6·2	12·32	11·17
22	5·39	6·32	5·56	6·1	1·28	12·12
						p.m.
23	5·39	6·31	5·56	6·1	2·22	1·2
24	5·40	6·30	5·56	6·0	3·11	1·49
25	5·41	6·29	5·57	5·58	3·35	2·32
26	5·43	6·27	5·57	5·57	4·36	3·9
27	5·44	6·26	5·58	5·55	5·9	3·41
28	5·45	6·25	5·59	5·54	5·42	4·12
29	..	..	6·0	5·52	..	4·41
30	..	..	6·1	5·51	..	5·12
31	..	..	6·2	5·50	..	5·44

Phases of the Moon, Occultations, &c.

7 Feb.	☽ Last Quarter	7 22 p.m.
14 ,,	● New Moon	10 43 a.m.
21 ,,	☾ First Quarter	4 5 p.m.

Perigee, 12th February, at 9.18 p.m.
Apogee, 24th February, at 8.12 p.m.

On the 2nd, about 7 p.m., the Moon will be passing from west to east of Neptune, 3 degrees on its south side.

Venus, which has been drawing towards the Sun for some months, will be in inferior conjunction on the 5th, when it will be on the side of its orbit nearest the earth; distant about 23,678,000 miles. On the 14th it will rise at 4.37 a.m.

Jupiter, having advanced to Right Ascension 13·27 in Virgo, will become stationary on the 7th and almost to the end of the month. Retracing its path and apparently moving westward it will pass Spica, at a distance of 4 degrees, near the middle of March.

Saturn, in Capricornus, which sets at 8.13 p.m. in the middle of January, will draw nearer the Sun and set a few minutes after it on 1st February. On the 8th it will set with the Sun, but 2 degrees further south, becoming entirely lost as an evening star. At the time of the eclipse on the 14th, Saturn will be only one degree south of the Moon.

An occultation of Antares, the brightest star in Scorpio, will occur between 7 and 8 a.m. on the 9th. Observers will have to look almost overhead, especially if near Gympie or Maryborough. On the same day a very close conjunction of Mercury and Mars, in Aquarius, will occur about 9 a.m. in the north-east in broad daylight. Mercury will set 51 minutes after the Sun on the 9th, but after sunset may be noticeable in the twilight. Mercury sets at 7.20 p.m. on 1st February, and at 7.31 p.m. on the 14th, while Mars sets at 7.42 p.m. on the 1st and at 7.22 p.m. on the 15th.

What will be a total eclipse of the Sun to observers situated in the Pacific Ocean, between Alaska and New Guinea, will be a partial eclipse at Hong Kong, magnitude 0·5, and visible in Queensland as a partial eclipse of less magnitude before 9 a.m.

Mars will be only 3 degrees south of the Moon at 11 a.m. on the 15th. Binoculars or telescope will be necessary to see it. Eight hours later Mercury, in Aquarius, will be only 2 degrees south of the Moon when setting. On the 18th, Mercury will be at its greatest eastern elongation, 18 degrees from the Sun.

On the 24th, Mercury and Venus will become stationary, having reached their greatest eastern position in Aquarius and Capricornus respectively.

1 Mar.	○ Full Moon	8 26 p.m.
9 ,,	☽ Last Quarter	4 6 a.m.
15 ,,	● New Moon	10 8 p.m.
23 ,,	☾ First Quarter	11 44 a.m.

Perigee, 12th March, at 7.42 p.m.
Apogee, 24th March, at 3.54 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling.** Members of Agricultural Societies, **Five Shillings,** including postage. General Public, **Ten Shillings,** including postage.

QUEENSLAND AGRICULTURAL JOURNAL

VOL. XLI. 1 MARCH, 1934. PART 3.

Event and Comment.

Co-ordinating Agricultural Research.

AMONG the many important matters discussed at the annual conference of Ministers for Agriculture at Hobart last month was the need for co-ordinating the research and experimental work of the different States of the Commonwealth. The Queensland Minister (Hon. Frank W. Bulcock) said that overlapping and duplication occurred, and suggested the setting up of an organisation representative of the States, so that specific problems might be allotted to each State for investigation and, if possible, solution. He further suggested that State officers should confer on the proposal for establishing a basis for co-ordination.

Recommendations adopted by the conference included the following:—That eggs should be branded "chilled" before being placed in cold storage, except eggs intended for oversea export, which should be placed in cool storage in bond; that, to improve the quality of butter, dairy laboratories should be established in all States; that provision should be made in each State for registration of premises used for cool storage of eggs and other products; that the States should consider the possibility of adopting the Canadian system of regulating hatcheries; that the practice of taking an annual census of wheat varieties should be adopted by all States; that each State should undertake investigation work to improve the milling and baking quality of wheat; that action should be

taken to prevent the introduction of plant diseases in imported seed, and that the Federal authorities should consult State departments about the methods to be adopted; that States interested in tobacco production should consider the introduction of legislation similar to that in Queensland for preventing disease; that legislation for the branding of hides on economic lines should be adopted in all States; and that legislation controlling veterinary biological products should provide that no person except a qualified veterinary surgeon should use vaccine serum or a diagnostic agent without a permit or license.

Improving a National Asset.

COMMENTING on a report on grass experiments at Bybera, in the Goondiwindi district, which he had received recently from Dr. Hirschfeld, the Minister for Agriculture, Mr. Bulcock, commended this and similar projects for improving a national asset. Dr. Hirschfeld, he said, was performing a national work, and was not asking the department for financial assistance in the undertaking. He would be safe in saying that no individual within the State was making a greater contribution to the knowledge of grasses than that gentleman.

Seed should not, according to the report, be planted for pastoral purposes in small plots, as the wind carried it from one plot to another, and might falsify results. Experiments extending over one or two years furnished no definite conclusions, but the best instance was furnished by the Buffel grass. Dr. Hirschfeld added that he was concerned over his failure to obtain anything like a fair growth of the different varieties of saltbush, particularly old man saltbush. This failure was all the more remarkable as some of the saltbushes grew naturally on the place, though not abundantly.

Regarding Flinders and Mitchell grasses, Dr. Hirschfeld is quite satisfied that the results of the experiments on Bybera will bear nation-wide fruit. It is clear, however, that the experiments represent only the first stage of the work. The second stage, on which Dr. Hirschfeld and his son, Mr. R. S. Hirschfeld, intend to embark later, will be to ascertain the reaction of stock to the grasses, as the final judges are the bullock and the sheep. Dr. Hirschfeld's report concludes with the statement that whatever results are obtained will not only be for private use, but will be at the disposal of all the people of the West.

The Queensland Meat Industry.

"IT is certainly essential to develop the export market . . . and it is necessary to co-ordinate domestic with overseas markets, for the exporter must be assured of profitable working and steady supplies." Those remarks were among the chief points of the opening address by the Minister for Agriculture (Mr. Bulcock) at the recent conference of representatives of the meat industry in Brisbane. Mr. Bulcock, in the course of further remarks, said that the conference had been convened under his presidency at the request of the Premier (Hon. W. Forgan Smith), who, he regretted, was unable to preside, on account of his being otherwise engaged at the Premiers' Conference in Melbourne. Continuing, he said that he had the assurance of the Premier that the

Government desired the devising of some effective means whereby the interests of the industry might be actively and adequately promoted. The Premier was convinced that some basis of organisation satisfactory to all concerned could be evolved, and hoped that the conference would be frank and complete in its recommendations, which would be considered on the Premier's return from the South.

It was certainly essential, added the Minister, to develop the export market, and he had observed with satisfaction that the producers' organisations had already arrived at the conclusion that it was necessary to co-ordinate domestic with overseas markets, and that the exporter must be assured of profitable working and continuity of supplies. He was convinced that for marketing boards to succeed a high degree of efficiency was required, and he believed that in the near future all the commodity boards in Queensland would be asked individually to become associated with the development of further markets. In formulating any plans for any new organisation that was contemplated, he hoped that the fact would not be lost sight of that the consumer had a right to consideration; also that efficiency in production was demanded by modern marketing methods. Stabilisation of prices must be backed by efficiency in organisation; otherwise the results sought would not be achieved. Any proposals submitted should lead to the material and progressive elevation of the standard of the industry. Information had been received from overseas that in many cases our meat had not compared favourably in quality with meat from other countries. It was essential, therefore, to strive to maintain a degree of efficiency in production, treatment, and transport comparable at least with that of our competitors on the markets abroad. Other matters which merited consideration at the conference were the provisions of the Ottawa Agreement relating to the supply of meat to the British market; proper provision for the domestic meat supply at wholesale prices to be determined by an independent tribunal on lines similar to the Cane Prices Board; provision for the purchase of vealers from farmers to supply the local retail trade, as well as the export market; a conference with pig raisers as to the best means of arranging for the disposal of fresh pork. Definite protection would have to be given to the pig raising industry, remarked Mr. Bulcock, as it had not yet been correlated with other branches of the meat industry.

In the course of the general discussion that ensued, it was plain that the consensus of opinion was definitely in favour of the complete organisation of the meat industry on lines similar to that governing other primary industries in Queensland. The Government, it was suggested, might be requested to proclaim meat as a commodity under the Primary Producers' Organisation Acts to enable a poll to be taken of the meat producers of the State to determine whether they would be in favour of such an organisation. A committee was appointed to consider this suggestion in all its implications, and, if adopted, to submit a recommendation regarding a proclamation to the Government for approval.

The Sugar Industry—Surplus Production Problem.

ADDRESS BY THE PREMIER.

Subjoined is the full text of the notable address with which the Premier, Hon. W. Forgan Smith, opened the recent Conference of representatives of every section of the Queensland Sugar Industry in Brisbane. At that Conference the Peak Year Scheme was discussed, and the principles underlying it were unanimously reaffirmed.

The Premier's appreciation of the surplus production problem will be read with interest by all concerned with the welfare and progress of one of Australia's greatest agricultural industries.—Editor.

IN his opening address at the Sugar Conference in the Land Court, Brisbane, on 24th January, the Premier, Hon. W. Forgan Smith, said:—

I desire, on behalf of the Government of Queensland, to welcome you to this Conference and to express the desire that the work of the Conference will be in the interests of the State and of the industry.

Important questions of policy, as well as those of domestic concern, that are exercising the minds of those engaged in the industry at the present time were the factors which influenced the Government in convening this Conference.

It is the desire of the Government to obtain an expression of views from the industry upon such subjects.

It is not the intention of the Government that the Conference should go into minute details, nor is it intended to interfere in any way with the duly constituted tribunals functioning in connection with the industry. There are, however, large questions of principle which are vital to the well-being of the industry, and which might be taken into consideration by this Conference.

For instance, the Government has received representations regarding the relationship between the peak year quotas and the areas assigned. As to the Peak Year Scheme: this operated, it will be remembered, as from the 1930 crop, and the principle it enunciated was accepted as part of the 1931 Sugar Agreement between the Commonwealth and the State Governments. It has also been affirmed by the Sugar Associations at their annual conferences; and there is also this point, that, whilst the Peak Year Scheme was put into force by the Government of my predecessor, I recall the fact that, at the request of the industry following the conference last year with the Commonwealth Government at which Senator McLachlan presided, the present Government became a party to it.

Solvent Demand and Increased Productivity.

I have stated on previous occasions that the restriction of production is akin to a policy of despair, and I believe that world progress depends on the increasing of solvent demand and the sharing by all industrious people in the increased productivity that modern methods in industry and agriculture have made available to mankind. The world position, however, must be viewed from those angles that have emerged from time to time. In this respect the world's sugar position is in a deplorable state.

The World Sugar Position—Possible Future Developments.

Recent happenings that may portend developments in the near future are as follows:—

(1) The differentiation in regard to British preference as between sugar from the British Crown Colonies and the Dominions. —It was announced in the 1932 Budget Statement of the British Chancellor of the Exchequer that there would be an increased preference of 1s. per cwt. on all Colonial sugar entering the United Kingdom market during the next five years. No alteration, however, was made so far as Dominion sugars were concerned.

(2) Request from the Sugar Federation of the British Empire by deputation to the British Government in March, 1932 (with which the Acting Agent-General for Queensland was associated)—that the duty on foreign sugar entering the United Kingdom market be increased.—This was found unacceptable to the British Government.

(3) The Ottawa Conference.—The existing preferential margin on sugar in the United Kingdom market was stabilised until August, 1937.

(4) The Beet Sugar Industry.—Information in the Government's possession shows clearly that the Imperial Government is determined to encourage and pursue their policy of assisting by subsidy or otherwise the home beet industry in Great Britain.

(5) The World Economic Conference.—The United Kingdom Government was then anxious for the various sugar-producing countries represented on the Sugar Committee to arrive at some agreement based on the principle of restriction and stabilisation of supplies.

A statement in the House of Commons on 30th November, 1933, by Sir Philip Cunliffe-Lister, the Colonial Secretary, emphasised the British Government's views on the need for sugar regulation. In the course of a considered statement the Colonial Secretary said:—

"At present the world's potential output of sugar is very largely in excess of the figures of consumption. That excess of productive power is partly held in check by an agreement between the principal exporting countries; but without a continuation and an extension of that agreement, there is a real risk of such an unregulated flow of sugar on the market as will lead to a complete collapse in price."

That statement is one worthy of very serious consideration by the sugar-producing interests of this State. The Agent-General in London has kept the Government fully informed of the overseas position.

The differentiation as between preference on Colonial and Dominion sugars entering the United Kingdom market illustrates an event which might be regarded as a precedent by interested parties, in further limiting the export of sugar from the Dominions to Great Britain.

I may say that in the representation made to the Secretary of State for the Dominions urging that Dominion sugar may be placed on the same basis as sugar from Crown Colonies, a statement was made by Mr. Thomas that the British Government owed a responsibility to these Crown Colonies that did not exist to anything like the same extent in regard to countries having complete Dominion status. Such a differentiation, if continued or enlarged, would intensify our difficulties here. It is not suggested that these things may happen, but reference is made to them to indicate the close touch which the Government is maintaining with the trend of events on the overseas markets. The matters just mentioned were reviewed succinctly in the last report of the Agent-General presented to Parliament last year.

The Difficulty of the Sugar Situation in Queensland.

The Government recognises the difficulty of the position. On one hand, it is claimed from certain areas that the net area assigned by a duly constituted tribunal represents such a quantity of excess sugar as to seriously affect their returns. On the other hand, it is stated that to reverse the position would be to pass on to others not responsible and less able to bear it the loss referred to.

The question of anomalies has been looked into. It is found that certain areas with complaints of unfair treatment—notwithstanding, or because of excess production—have greater tonnages per farmer and greater returns per farmer than certain other districts.

The Price of Sugar—Queensland Opposition to Reduction.

In regard to the price of sugar, the Queensland Government strenuously opposed the reduction made at the instance of the Commonwealth Government, but, in accordance with its practice, acceded to the industry's representations in this connection.

Restrictions and quotas have been advocated and made in respect of such commodities as meat and butter. Restrictions have been effected in regard to these commodities, and further restrictions are indicated from time to time by the central authority in London, so that the policy of definite restriction, or at least control of market conditions, can be regarded as an established fact, whether we like it or not; and we as a Conference must look these facts in the face and shape our policy accordingly.

This brief review will serve to illustrate the position as it exists to-day. It indicates the trend of world events and their relation to sugar supplies from the sugar-producing countries.

The Peak Year Scheme.

The provision of the Peak Year Scheme is associated with the facts as described in this review, particularly in respect to any questions of increasing the peak year tonnage *in toto.*

As to matters under our own control, the Government has had requests for inquiries by tribunals in regard to assignments, peak year,

&c., but we have considered it desirable to take the industry into our confidence and have the benefit of the views expressed at this Conference. A conference, such as has been convened, was responsible for the present system, and within the limits allowed under the Sugar Agreement at present existing between the Commonwealth and the State, the Government seeks to ascertain your views.

The Sugar Embargo.

Then there are other factors—

1. The embargo has been given to the industry on account of the importance of settlement and employment in Northern Australia.
2. The embargo carries with it important obligations in this regard.
3. These considerations must be carefully weighed as against the effect which excess production has upon the financial returns to producers engaged in the industry.

The Conference will undoubtedly recognise the importance of these phases of its deliberations.

Co-operation Essential.

Co-operation in the industry is essential. I ask delegates to cast aside any preconceived ideas, and debate the matter for the advice of the Government and for the ultimate benefit of the industry and the State.

The Premier's address was listened to attentively, and was applauded most cordially.

TO NEW SUBSCRIBERS.

New subscribers to the Journal are asked to write their names legibly on their order forms. The best way is to print your surname and full christian names in block letters, so that there shall be no possibility of mistake.

When names are not written plainly it involves much tedious labour and loss of valuable time in checking electoral rolls, directories, and other references. This should be quite unnecessary.

Some new subscribers write their surname only, and this lack of thought leads often to confusion, especially when there are other subscribers of the same surname in the same district.

Everything possible is done to ensure delivery of the Journal, and new subscribers would help us greatly by observing the simple rule suggested, and thus reduce the risk of error in names and postal addresses to a minimum.

Covered Smut of Barley.

By R. B. MORWOOD, M.Sc., Assistant Plant Pathologist.

COVERED smut of barley frequently reduces the yield and, to a more marked extent, the quality of barley crops in Queensland. The disease can first be observed when the plant comes into ear. In the affected plant the grain with its enclosing glumes is replaced by a compact black mass, which consists of countless numbers of minute black spores. When a crop containing diseased plants is harvested, the spores lodge on the unaffected seed and between the adherent glumes of such seed. If seed contaminated with spores is planted, the spores germinate at the same time as the seed and infect the seedling. The infection cannot be observed in the growing plant as it only makes itself apparent just prior to the following harvest.

Control.

The only stage in the life history of the fungus which offers a reasonable opportunity for controlling the disease is that in which the spores are adhering to the grain. If the spores can be destroyed or rendered innocuous by the application of a suitable fungicide to the grain, then no infection could take place. Experiments to determine the best methods of treating the grain for this purpose have been conducted in England,[1] America,[2, 3, 4, 5, 6] and New Zealand[7]. The results obtained showed that the wet treatment with bluestone and dry treatment with copper carbonate, which are in general use for the control of bunt of wheat, were not satisfactory for barley or, rather, were satisfactory only in the case of skinless barley.[8] On the other hand, formalin and a number of solutions containing mercury compounds were found to give good control of the disease. Treatments with dusts other than copper carbonate have been tried with varying success. Those found to be best were Hochst, Abavit B, and Ceresan, the active constituents of which are mercury compounds, and the formalin dust Smuttox. Numerous other mercury dusts, when tested, proved ineffective or only partially effective. Smut can be eliminated from barley seed by treatment with hot water at certain temperatures without destroying the viability of the grain.[7] Considerable apparatus and skill are required for the operation. It can be used for the treatment of a small quantity of seed which can be grown in isolation and the resultant seed, if uncontaminated, used for the following season without treatment. This system has been successfully applied in one district in New Zealand[9] by a seed firm which has the necessary facilities for treatment, growing the treated seed and harvesting the resultant crop without allowing contamination. Detailed discussion of the hot water treatment is not included in these notes, as it is not considered practicable for recommendaion to individual farmers.

Queensland Experiments.

A preliminary trial was carried out in 1931 to test the relative values of a number of methods of seed treatment.[10] Nine of these were included using plots each of a single drill two chains long and replicated six times. The results, though meagre, indicated the ineffectiveness of copper carbonate and suggested that the organic mercury dusts might compare favourably with formalin. This result was followed up the next year by another series of single drill plots, and a second experiment using larger drill-sown plots in which only three treatments were used. The former yielded no results owing to the failure of the plants to mature

under the dry conditions prevailing in the district in which they were sown. The drill-sown plots were planted on Mr. W. Franke's farm at Nobby where they met with more favourable conditions.

The experiment consisted of the comparative trials of three fungicides—formalin used in solution and two mercury dusts—Tillantin R and Abavit B. Approximately one bushel of smutted seed was treated with each and sown in nine plots, three for each treatment. A strip was also planted with untreated smutted seed. The seed was planted on the day after it was treated. The stand obtained in all plots was good, and a count of seedlings in selected areas showed no significant loss of germination for any seed treatment. However, laboratory germination tests started a few days later indicated that the seed treated with formalin deteriorated rapidly after treatment. There was no such effect with the dusts.

At harvest time the untreated plot developed a serious amount of smut. A count of a few sample areas gave the proportion of smutted ears as 7 per cent. This amount would on threshing result in a heavily smutted sample of seed. With formalin and Tillantin R the proportion was reduced to 0·2 per cent., and with Abavit B no trace of smut could be found. The figures below for the number of infected plants in two rows each 12 chains long of each plot give some indication of the relative values of the treatments.

Treatment.	First Plot.	Second Plot.	Third Plot.	Average.
Untreated	215	..	..	215
Formalin	2	1	10	4·3
Abavit B	0	0	0	0
Tillantin R	7	6	6	6·3

These results were striking, and it was decided to attempt to confirm the apparent outstanding value of Abavit B, and to this end a series of trials was carried out in 1933. Drill-sown plots were again put in on Mr. Franke's farm to compare three seed treatments, namely, formalin, Abavit B, and bluestone, and single drill plots on the Roma State Farm.

Single Drill Plots.

In the second experiment the single drill plots were used to test a greater variety of materials and, in some instances, different strengths of the substance. Unfortunately, the degree of infection which developed in this experiment was somewhat low, and as the plots were small and replicated only three times, the results were not as conclusive as could be desired. The experiment demonstrated differences between untreated and treated seed, but failed to sort out the substances which were partially effective from those of greater value. However, it allowed of the making of accurate counts of the germination of the seed after the various treatments. These counts indicated that there was no significant loss of germination with any treatment excepting when formalin was tried at a strength greater than that normally recommended, or with longer periods of immersion. Formalin treatment consisting of the dipping of the seed for ten minutes in a solution of formalin made up at the rate of 1 lb. to 30 gallons of water does not reduce the percentage germination of the seed if it is planted in moist soil on the day following treatment.

The smut developing in the single drill plots indicated that copper carbonate and one of the organic mercury compounds, namely, Tillantin R, are only partially effective against barley smut. Furthermore, Abavit B, which had previously proved very effective when applied at the rate of 2 oz. per bushel, lost its efficiency with any reduction of the amount below this figure.

Drill-sown Plots.

The drill-sown experiment consisted of plots four hoes wide and 12 chains long. Thirty plots were sown, being ten replications of three treatments. A single 12-chain strip the full width of the fourteen-hoe drill was planted with untreated seed along one end of the paddock where it could be conveniently destroyed prior to harvest. A commercial sowing of about seven acres was made with seed treated by the method giving the best results last year, namely, Abavit B at the rate of 2 oz. per bushel. The same seed was used throughout. It was obtained from a lightly smutted crop and had been cleaned and freed from smut balls. No further artificial infection was attempted.

One bushel of seed was used for each of the three treatments for the small replicated plots. The treatments were as follows:—

(1) Bluestone.—The seed was dipped into a 1½ per cent. solution of bluestone for three minutes. It was then spread out to dry.

(2) Abavit B.—The seed was dusted with Abavit B at the rate of 1 oz. per bushel by rotation in a closed box.

(3) Formalin.—The seed was dipped into a 1 : 240 solution of formalin for ten minutes. This solution is equivalent to 1 pint of formalin in 30 gallons of water. The seed was then heaped and covered with a bag which had been soaked in the solution. It was then left overnight and bagged and sown next morning.

Results.

A severe attack of corn-ear worm destroyed a portion of the crop, but sufficient remained to show definite evidence of the value of formalin and of Abavit B used at full strength. Table I. gives the numbers of smutted plants per plot. Table II. gives the approximate percentage of infected plants obtained from the average of these figures, and also estimates of the amount of smut in the commercial planting and in the untreated strip. The estimates for the last two were obtained by counts of areas comparable to the plots, chosen at random through the crop and strip respectively. Corresponding figures for the previous year's experiment are included for comparison.

TABLE I.

Treatment.	Number of Smutted Plants per Plot.										Average.
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	
Bluestone, 1½ per cent., 3 min.	14	27	21	30	19	20	25	28	16	31	23·1
Abavit B, 1 oz. per bus. ..	17	25	15	23	20	10	21	25	30	21	21·2
Formalin, 1 : 240, 10 min. ..	2	4	1	3	3	1	2	1	0	1	1·8

TABLE II.

ESTIMATED AVERAGE PERCENTAGE SMUTTED PLANTS.

Treatment.	1932.	1933.
Bluestone, 1½ per cent., 3 min. dip	..	0·23
Abavit B, 1 oz. per bus.	..	0·21
Formalin, 1 : 240, 10 min. dip	0·15	0·02
Abavit B, 2 oz. per bus.	..	0·02
Untreated	7·00	4·20
Tillantin R	0·20	..

The degree of control exercised by formalin and Abavit B at the rate of 2 oz. per bushel could be classed as good commercial control. No doubt even better results would be obtained by the use of seed reasonably free from smut in the first instance.

Discussion.

At the conclusion of three years' experiments in the control of barley smut there appear to be two substances of considerable merit, namely, Abavit B and formalin.

The use of the dust Abavit B has several advantages over the liquid treatment with formalin. It has given more consistently good results in the trials. It is easier to apply and has no detrimental effect on the germination of the seed. Formalin probably always slightly retards germination, and will, if incorrectly applied or used under adverse conditions, seriously reduce the total germination. Further, the dust can be applied at any time and the treated seed stored indefinitely; in fact, owing to the protection from weevils afforded by the dust, treated seed is likely to keep better than untreated grain. The risk of recontamination with smut is a factor for consideration when formalin is used, but not for Abavit B, as the latter remains on the grain and will deal as effectively with smut spores received after treatment as with those present before. Treatment with Abavit B does not appreciably alter the rate at which the seed runs through the drill, as does the wet treatment.

The advantages in the use of formalin are the lower cost of materials and the non-poisonous nature of the seed after treatment.

It is proposed to continue the seed treatment trials along two lines, namely, the testing of other methods of treatment with formalin and of mercury dusts other than Abavit B. Certain of these latter have given good results overseas and in preliminary trials in Queensland.

Methods of Seed Treatment.

Abavit B should be applied at the rate of 2 oz. of the powder to each bushel of barley. It should be thoroughly mixed in a rotating, dust-tight container such as is used for the treatment of wheat with copper carbonate. Those unfamiliar with this piece of apparatus can obtain particulars of construction from this Department. Owing to the highly poisonous nature of the dust, all seed treated with Abavit B should be planted to avoid the possibility of its being consumed by domestic animals.

The formalin should be diluted by adding 1 pint of commercial (40 per cent.) formalin to 30 gallons of water. A suitable quantity of the seed should be placed loosely in an open bag and dipped into the solution. It should be stirred to ensure of the wetting of all the grain and allowed to remain in the solution for ten minutes. Excess solution should then be drained back into the container and the seed heaped and covered with bags soaked in the solution. Meanwhile further quantities of seed may be dipped in the same solution, more of the mixture of water and formalin being added to make up for that carried away on the grain. Seed so treated should be sown the following day in a good moist seedbed.

Formalin is poisonous, but after the fumes have evaporated from the seed it is no longer poisoned. Recontamination of the treated grain by the use of smutty bags, &c., should be avoided. The treated seed will not flow through the drill as readily as untreated, so the drill should be set to a higher rate of seeding than that required for the latter.

Acknowledgments.

Special acknowledgment is made of the help received from Mr. W. Franke and Mr. Soutter and the staff of the State Farm, Roma, who provided both the facilities and assistance for carrying out the experiments. Mr. A. C. V. Bligh kindly supplied samples of Abavit B.

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Bunchy Top of the Banana and its Control.

By J. H. SIMMONDS, M.Sc., Plant Pathologist.

THE occasional outbreak of bunchy top in plantations situated some distance from all known sources of infection makes it imperative that every banana-grower should be familiar with this disease even though it has not been found in his vicinity. The following short account has therefore been prepared for those who are unacquainted with this malady.

How to Recognise Bunchy Top.

A plant which has had bunchy top for some time is easily recognised, since once it has been infected all the new leaves produced take on a characteristic appearance. For example, the youngest leaf unfolds in a somewhat restricted manner. The edges appear to be contracted, so that each side of the blade tends to remain curled upwards and inwards to a greater extent than in the healthy plant. The older leaves, instead of having enlarged and expanded naturally, are seen to be shorter and narrower than normal. They have a margin which is decidedly waved, with usually a pronounced upward curving. These leaves have a stiff appearance, and are brittle when crushed. The leaf stalk is shortened and fails to bend over in the usual graceful way. The combined result is that the short, narrow leaves are borne in a stiff, erect, and crowded manner, from which is derived the name of bunchy top (Plate 73).

However, no grower should allow a plant infected with bunchy top to remain in his plantation long enough for these advanced stages to be obvious. The plantation should be carefully examined at regular intervals for any plant showing in the slightest degree an abnormal appearance. Especially should the grower investigate plants whose youngest leaves exhibit a lighter green colour along the edge and have blades which dip back from the midrib and curve in again conspicuously from the margin (Plate 74). Any suspicious plant should then be more closely examined for certain characteristic symptoms which are present even in the early stages of the disease. These symptoms are seen by examining the base of the youngest leaf from the under side and with the light behind it. If the plant is infected there will be noticed short, broken, or sometimes continuous lines of a dark-green colour lying between, and parallel to, the clear veins which run out at right-angles to the midrib (Plate 72). There are also often one or more wider dark-green streaks running down the outside of the leaf stalk near its junction with the pseudostem.

Points Concerning the Nature and Spread of Bunchy Top.

Before proceeding to discuss the steps necessary to overcome bunchy top it is important that the reader should know something of the nature of the disease and the means by which it is spread. Bunchy top is unlike the majority of plant diseases, in that it is not caused by a fungus or bacterial organism, but by an infectious agent smaller than any of these—so minute, in fact, that it can not be seen even with a high-power microscope. This causal agent, or virus, as it is commonly called, is located in the sap of an infected plant.

In a single stool the virus from a diseased parent plant may travel in the sap stream down to the corm, and out through the connecting tissue to the young suckers, which will in turn develop the disease (Plate 73). Hence the necessity for two features in the control methods outlined later; namely, the eradication of the whole of the stool rather than merely the plant showing symptoms at the time, and the securing of suckers from bunchy top free plantations.

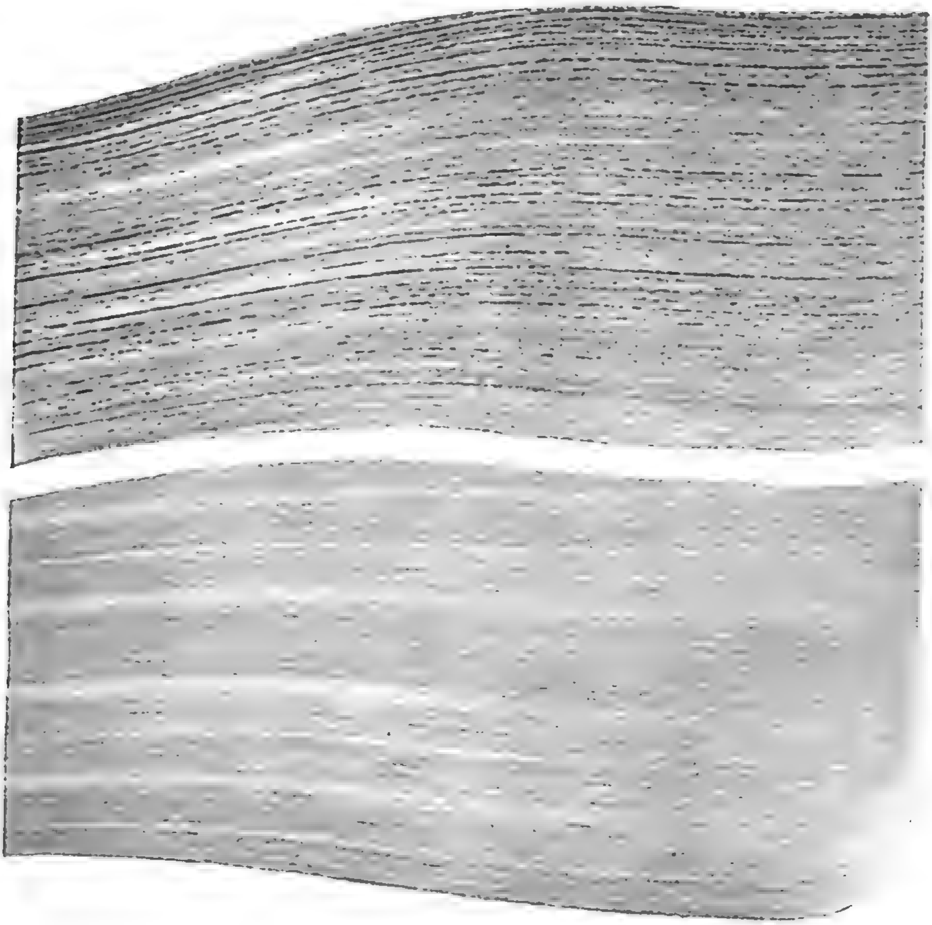

PLATE 72.

Portions of banana leaves photographed from the underside by both transmitted and reflected light. Above: Leaf from bunchy top infected plant showing the characteristic dark dots, dashes, and lines. Below: Leaf from a healthy plant for comparison.

To transmit bunchy top to a plant in another stool it is necessary to transfer the virus-containing sap from an infected plant to a healthy one. Under natural conditions this is done by the banana aphis when it sucks the sap of a diseased plant and then leaves it to feed on a healthy one. Aphids may travel for considerable distances in the air, which accounts for isolated outbreaks of bunchy top in plantations otherwise free from the disease.

The active part taken by the banana aphis in spreading bunchy top explains why the destruction of all aphids on infected plants is an important part of the control measures discussed below. The banana aphis is so widely distributed that an attempt to control bunchy top by the total eradication of this insect throughout a whole plantation is considered commercially impractical.

Once a banana plant is infected the virus never leaves it. There is no known method of destroying the virus in the plant by the application of chemicals or otherwise, except by destroying the plant itself. In other words, it is not possible to cure a plant of bunchy top.

Plate 73.

The result of not completely eradicating a stool in which bunchy top has appeared. The plant on the right shows primary infection with bunchy top contracted when as a sucker it had direct union with a diseased parent before the latter was removed. The plant on the left is healthy.

The Control of Bunchy Top.

From the foregoing remarks it will be seen that there are two main aspects in the control of bunchy top. Firstly, care must be taken that all suckers used for planting material are free from bunchy top infection. Secondly, the number of bunchy top infected plants must be reduced to the absolute minimum by their eradication as soon as disease symptoms appear. By this means the source of supply of the virus is eliminated.

The Banana Industry Protection Board has been giving considerable attention to the control of bunchy top. The Board's agents are in a

position to advise where suitable material, free from bunchy top, may be obtained. When considering planting, growers should apply to their local agent for information on the planting policy in their district, as a planting permit may have to be refused if it is considered that the spreading of bunchy top or other disease or pest is involved.

For the location of bunchy top plants in his plantation the grower must not depend on the occasional visits of the banana agent, but must himself make regular and systematic search for diseased plants. If an infected plant is found, it and any associated aphids must be immediately destroyed, as otherwise it remains a menace to healthy plants in the same or adjoining plantations.

PLATE 74.

Two banana plants showing the symptoms of a fairly recent infection with bunchy top. In the younger leaves notice the dipping back of the blades from the midrib and the incurved and waved condition of the margin.

In order that the eradication operation may be uniformly effective, the following procedure must be followed. First pour not less than half a pint of pure kerosene into the central leaf of the affected plant, and allow it to trickle down round the leaf bases, so that all aphids present may be killed. After waiting for a few hours for this to take place, dig out the plant, together with any other plants and suckers connected with it in the stool. Finally chop the plants into small pieces to facilitate drying. As a further precaution, the plants associated with the affected one in the stool should also be kerosened before removal.

With strict attention to these matters bunchy top need never become a serious disease, but if the work is allowed to become haphazard, only a disaster such as attended the Currumbin and Tweed growers some years ago may be expected.

Worm Parasites of Domesticated Animals in Queensland.

By F. H. S. ROBERTS, M.Sc., Entomologist, Animal Health Station, Yeerongpilly.

THESE notes are intended as a check list of the worm parasites so far collected from the domesticated animals in Queensland. The majority have already been recorded by Johnston *et al.*, but during the past three years a number of species have been obtained by the writer which had not previously been known from this State. The material examined was obtained mainly from animals slaughtered at the Brisbane Abattoir and from animals used for experimental purposes at this station. A small portion consisted of specimens forwarded from various parts of Queensland for identification. The dog, cat, and horse have, so far, been given very little attention, consequently the parasites recorded from these animals are relatively few.

Nematoda.

Strongyloides sp.—These tiny nematodes are exceedingly numerous in cattle, sheep, and pigs.

Trichuris trichuria (L., 1771).—Very common in the pig and often present in very large numbers.

Trichuris ovis (Abild., 1795).—Frequently found in the cœcum and colon of cattle and sheep.

Capillaria retusa (Raill., 1893).—Very common and numerous in the intestine of the domestic fowl.

Capillaria columbœ (Rud., 1819).—This species has been found in the small intestine of the domestic fowl and domestic pigeon.

Strongylus equinus (Mul., 1780).—Specimens from the large intestine of the horse have frequently been seen and indicate that this species has a wide distribution throughout the State.

Strongylus vulgaris (Looss, 1900).—This species is also a common parasite of the horse, occurring over a wide area.

Strongylus edentatus (Looss, 1900).—This Strongylus does not appear to be as common as *S. vulgaris* and *S. equinus.*

Trichonema sp.—There are at least about ten species of this and allied genera from the horse in the collection. Johnston has recorded *Trichonema tetacanthum.* The Trichonemas are small worms occurring in the cœcum and colon of the horse, and in their immature stages cause nodule formation in the intestinal wall.

Œsophagostomum columbianum Curtice, 1890.—The sheep nodule worm is extremely common and is a widely distributed sheep helminth. The excellent condition of many sheep killed at the abattoir in which the intestines were simply riddled with nodules would indicate that the species is comparatively harmless. Grown sheep certainly appear able to resist infestation by this worm to a large extent, but among young animals the parasite must be regarded as being definitely harmful, the effect of its presence being mainly shown by the failure to make normal growth. The sheep nodule worm is also recorded from cattle and goats

Œsophagostomum radiatum (Rud., 1803).—The nodule worm of cattle is also well distributed and frequently seen.

Œsophagostomum dentatum (Rud., 1803).—This is the common nodule worm of pigs and is considered to be one of the most prevalent worm parasites of this animal in Queensland.

Œsophagostomum longicaudum Goodey, 1925.—This strongyle is only occasionally seen and is usually found in company with *O. dentatum.* It may be readily recognised by the position of the cervical papillæ, by the long tail of the female, and the vase-like shape of the œsophagus.

Ancylostoma caninum (Erc., 1859).—Obtained on several occasions from the dog in Brisbane and Townsville. This hookworm is also frequently found in the cat.

Ancylostoma duodenale (Dubini, 1843).—Recorded by Legg and Rheuben from the intestine of the pig at Townsville.

Necator americanus (Stiles, 1902).—This species is the more common hookworm of man in Queensland and is also recorded from the pig by Legg and Rheuben.

Bunostomum phlebotomum (Rail., 1900).—This cattle hookworm is known from Brisbane and Townsville and is probably well distributed throughout at least the coastal areas of the State. It may be regarded as being a not uncommon bovine parasite, and is thought to be partly responsible for the unthriftiness of calves in areas where it is known to exist.

Stephanurus dentatus (Dies., 1839).—The pig kidney worm is very common and has an extensive distribution throughout the State, its prevalence increasing so rapidly towards the tropical portions that a very large percentage of the animals here are infested. It is responsible for severe liver damage, which results in retarding the growth of the infested animal to a very conspicuous extent. Immature specimens of this helminth have been collected on two occasions from the livers of calves.

Hæmonchus contortus (Ru., 1803).—Very common in the abomasum of sheep, cattle, and goats. It is a most pathogenic and widely distributed sheep helminth and is responsible for serious losses yearly. It is also responsible for mortalities and unthriftiness among calves, especially in the coastal areas. In cattle the linguiform process overhanging the vulva in the female is reduced to a small knob.

Nematodirus filicollis (Rud., 1802).—Taken on a few occasions from the small intestine of sheep but not regarded as being a frequent parasite.

Ostertagia circumcincta (Stad., 1894).—Frequently found in the fourth stomach of sheep, rarely in cattle. It has never been seen in large numbers, and is not regarded as a serious parasite.

Ostertagia ostertagi (Stiles, 1892).—This is one of the most frequent cattle helminths in Southern Queensland at least, but heavy infestations have not yet been observed. It has been taken on one occasion from the abomasum of the sheep in company with *O. circumcincta.*

Cooperia curticei (Rail., 1893).—Rare in the small intestine of the sheep.

Cooperia punctata (V. Linstow, 1907).—This species is represented by two males from the duodenum of a calf.

Cooperia pectinata Ransom, 1907.—Dickmans has recently drawn attention to Baylis's *C. nicolli* as a synonym of *C. pectinata.* Baylis erected his species on the larger spicules and ovijectors, the spicules being ·35 to ·39 mm. in length and the ovijectors ·48 to ·60 mm., as against Ransom's measurements for *C. pectinata,* spicules ·24 to ·28 mm. and ovijectors ·3 mm. In the series examined by the writer the spicules measured from ·24 to ·38 mm. and the ovijectors ·31 to ·58 mm. *C. pectinata* was moderately frequent in calves examined at the abattoir.

Cooperia fieldingi Baylis, 1929.—Recorded by Baylis from the small intestine of cattle in North Queensland.

Trichostrongylus extenuatus (Rail., 1898).—Very frequent in sheep though only in small numbers. This species has also been taken from cattle, and is recorded by Heyden from goats.

Trichostrongylus colubriformis (Giles, 1892).—This appears to be the most common species of Trichostrongylus in Queensland sheep. An intense survey would probably record the existence of other species of this genus. *Trichostrongylus sp.* is regarded in the Southern Australian States as an exceedingly pathogenic group, but in Queensland has been seen only in moderate numbers. Heyden records *T. colubriformis* from the goat and man.

Ornithostrongylus quadriradiatus (Stev., 1904).—Occurs in the domestic pigeon.

Hyostrongylus rubidus (Has. and Stiles, 1892).—This slender nematode has been collected on several occasions from the stomach of the pig but never in any numbers.

Metastrongylus apri (Gmel., 1790).—This lung worm of the pig is recorded from the Moreton district. It inhabits the bronchioles.

Chœrostrongylus pudendotectus (Wostokow, 1905).—A few specimens of this pig lung worm were obtained from a pig at Riverview in company with *M. apri.*

Dictyocaulus filaria (Rud., 1809).—The large lung worm of the sheep is frequent in Southern Queensland where, during the spring months especially, it is responsible for occasional losses.

Dictyocaulus viviparus (Bloch, 1782).—The cattle lung worm is very prevalent among calves of dairy cattle in Coastal Queensland, especially in the South.

Dictyocaulus arnfieldi (Cobbold, 1884).—Said by Johnston to have been reported from horses by Bancroft in 1893.

Oxyuris equi (Schrank, 1788).—Very common in the large bowel of horses.

Heterakis gallinæ (Gmel., 1790).—Very frequent in the cœcum of the domestic fowl.

Ascaris lumbricoides (L., 1758).—One of the commonest and most widely distributed parasites of the pig.

Toxocara canis (Werner, 1782).—This species is very prevalent in the small intestine of dogs.

Toxocara mystax (Zedor, 1800).—Frequent in the small intestine of the cat.

Ascaris equorum Goeze, 1782.—Very frequent in the small intestine of the horse.

Ascaridia lineata (Schneid., 1866).—Very common in the domestic fowl, especially in young birds.

Ascaridia columbæ (Gmel., 1790).—Found in the small intestine of the domestic pigeon, and regarded as being very frequent.

Habronema megastoma (Rud., 1819).—Occurs in the stomach of the horse.

Habronema microstoma (Schneid., 1866).—Found in the stomach of the horse.

Habronema muscæ (Carter, 1861).—This is the most frequently encountered of the three species of this genus. Johnston, who worked out the life histories of the three species in Queensland, found that *H. muscæ* and *H. megastoma* may be transmitted by *Musca domestica, M. vetustissima, M. fergusoni, M. terræ-reginæ,* and *M. hilli;* whilst *H. microstoma* underwent its complete larval development only in *Stomoxys calcitrans.*

Arduenna strongylina (Rud., 1819).—Very common in the stomach of the pig, but seen only in small numbers.

Physocephalus sexalatus (Mol., 1860).—Frequently seen in the stomach of the pig, usually accompanied by *A. strongylina.*

Acuaria (*Cheilospirura*) *hamulosa* (Dies., 1851).—Frequent in the gizzard of the domestic fowl.

Acuaria (*Dispharynx*) *spiralis* (Mol., 1858).—Infrequent in the proventriculus of the domestic fowl.

Oxyspirura parvovum Sweet, 1910.—The eye worm of the domestic fowl is extremely common in North Queensland, but is unknown south of Rockhampton. The intermediate host of this nematode is the roach *Pycnocœlus surinamensis.*

Filaria lienalis (Stiles, 1892).—Recorded by Johnston as *Onchocerca lienalis* from the gastro-splenic ligament of cattle. The species has recently been placed in the genus *Filaria* by Sandground. It is not uncommon among Queensland cattle.

Onchocerca gutterosa Neuman, 1910.—Rheuben considered this species to represent the unincapsulated form of *Onchocerca gibsoni,* but in a recent revision of the genus Sandground gives it specific rank due to the constant presence of an inconspicuous dilation in the cervial region which is absent in *O. gibsoni.* Rheuben reports *O. gutterosa* as being extremely common, the principal sites of infection in the forequarter being the connective tissue of the *ligamentum nuchæ,* and in the subscapular connection tissue, and in the hind limb in the connective tissue below the quadriceps group of muscles and in that of the popliteal space.

Onchocerca gibsoni C. and J., 1910.—The beef nodule worm is very common and is a source of serious loss to the beef export trade. The worm is found in the region of the brisket and stifle. This species is also recorded from sheep.

Dirofilaria immitis (Leidy, 1856).—Recorded by Bancroft from the right ventricle of the dog. This filariid is said by Legg to be very common among dogs in North Queensland. Bancroft records the mosquito *Culex fatigans* as an intermediate host.

Gnathostoma hispidum Fedchenko, 1872.—This species is found in the stomach of the pig, and is represented in the collection by two specimens from the Cape York Peninsula.

Macracanthorhynchus hirudinaceus (Pallas, 1781).—The thorn-headed worm of the pig is occasionally but not frequently observed. It appears to be most common in the Beaudesert district.

Trematoda.

Paramphistomum cervi (Schrank, 1790).—This conical fluke is extremely common among cattle, especially in the coastal areas. It occurs sometimes in very great numbers in the rumen and has occasionally been seen in the reticulum, but does not appear to be in any way pathogenic. It is possible that more than one species of the genus is included here under this name.

Fasciola hepatica L., 1758.—The liver fluke has frequently been collected from the livers of cattle and sheep and on two occasions from that of the pig. There is now definite evidence that this fluke is endemic in the Maleny and Kingaroy districts in Queensland. In the Maleny district infestation of the few sheep there is comparatively common, whilst at Kingaroy the parasite was taken from the liver of a pig raised in the district. There is evidence that the species may also occur around Milmerran, but this is not conclusive. The molluscan intermediate host has not yet been determined.

Echinostomum revolutum (Frölich, 1802).—Obtained on one occasion from the rectum of the domestic duck. This species has been previously recorded from the black swan (*Chenopsis atrata*), the pied goose (*Anseranas semipalmata*), the green gooseteal (*Nettopus pulchellus*), and from the black duck (*Anas superciliosa*).

Cestoda.

Moniezia expansa (Rud., 1810).—Very common among lambs, especially on the Darling Downs, among which it may be pathogenic. This species is also recorded from calves and goats.

Moniezia benedeni (Moniez, 1879).—This tapeworm has been collected from calves. It may be distinguished from *M. expansa* by the larger scolex and the linear interproglottidal glands.

Moniezia trigonophora St. and Has., 1892.—Recorded by Johnston from sheep.

Moniezia planissima St. and Has., 1892.—Recorded by Johnston from cattle. The many species of *Moniezia* recorded by Stiles and Hassell from domestic ruminants have now been reduced to three, and it is probable that Johnston's *M. trigonophora* may be referred to *M. expansa* and his *M. planissima* to *M. benedeni*.

Helictometra giardi (Moniez, 1879).—Collected on several occasions from lambs in company with *Moniezia expansa*. Specimens have been taken at Miles, Dalby, Goondiwindi, and Springsure.

Anoplocephala perfoliata (Goeze, 1782).—Recorded by Johnston from the horse.

Anoplocephala magna (Abildg., 1789).—This is a much larger species than *A. perfoliata* and may be readily distinguished by the absence of posterior lappets on the scolex. The several specimens in the collection would denote that this horse tapeworm is not uncommon.

Dipylidium caninum (L., 1758).—There are several specimens from the dog bearing this label. The majority of these are minus the scolex and have only been given this name provisionally. This species has been recorded from the cat by Johnston in which it is not uncommon.

Echinococcus granulosus (Batsch, 1786).—Hydatid cysts are not uncommon in the liver and lungs of sheep, cattle, and pigs slaughtered at the abattoir. It may be inferred that the adult is present in dogs in Queensland.

Tænia hydatigena (Pall., 1776).—The larvæ of this dog tapeworm are very common in sheep and to a lesser extent in cattle and pigs. Its presence in dogs may be inferred from the incidence of its larva, *Cysticercus teniucollis.*

Tænia tæniæformis (Rud., 1810).—Johnston records this species from the cat. Its larva, *Cysticercus fasciolaris,* occurs in the livers of rats.

Tænia saginata (Goeze, 1782).—The beef tapeworm has been recorded from man on several occasions, but no record is known of the presence of its larva, *Cysticercus bovis,* in cattle. The species is probably not endemic.

Davainea proglottina (Dav., 1860).—This tiny tape is not infrequently found in the small intestine of the domestic fowl. Heavy infestations are not uncommon and are regarded as being markedly pathogenic.

Raillietina (Raillietina) tetragona (Mol., 1858).—Occurs in the small intestine of the domestic fowl and is the commonest fowl tapeworm in Southern Queensland.

Raillietina (Skrjabinia) cesticillus (Mol., 1858).—Fairly frequent in the small intestine of the domestic fowl.

Hymenolepis carioca (Magahl., 1898).—The incidence of this tapeworm in the domestic fowl is not regarded as high, though heavy infestations have occasionally been observed.

Hymenolepis inermis Yoshida, 1910.—Not uncommon in the domestic fowl, often occurring in large numbers.

Aporina delafondi (Rail., 1892).—Recorded by Johnston from the intestine of the domestic pigeon.

Diphyllobothrium mansoni (Cobbold, 1882).—This tapeworm is of frequent occurrence in the small intestine of the cat.

Fimbriaria fasciolaris (Pall., 1781).—Two specimens of this interesting tapeworm were obtained from a domestic duck in Brisbane. In both specimens the head was replaced by a pseudoscolex.

Host List with Parasites Recorded.

SHEEP (*Ovis aries*).

Fasciola hepatica.
Moniezia expansa.
Moniezia trigonophora.
Helictometra giardi.
Cysticercus tenuicollis.
Echinococcus granulosus.
*Strongyloides sp. (papillosus?).
Hæmonchus contortus.
Ostertagia circumcincta.
*Ostertagia ostertagi.
*Cooperia curticei.
Trichostrongylus extenuatus.
*Trichostrongylus colubriformis.
*Nematodirus filicollis.
Oesophagostomum columbianum.
Dictyocaulus filaria.
Trichuris ovis.
Onchocerca gibsoni.

CATTLE (*Bos taurus*).

Paramphistomum cervi.
Fasciola hepatica.
Moniezia expansa.
Moniezia planissima.
*Moniezia benedeni.
Cysticercus bovis?
*Cysticercus tenuicollis.
Echinococcus granulosus.
Hæmonchus contortus.
*Ostertagia ostertagi.
Ostertagia circumcincta.
*Cooperia punctata.
Cooperia pectinata.
Cooperia fieldingi.
Trichostrongylus extenuatus.
*Trichostrongylus colubriformis.
Dictyocaulus viviparus.
*Stephanurus dentatus.
Oesophagostomum radiatum.
Oesophagostomum columbianum.
*Bunostomum phlebotomum.
*Strongyloides sp.
Trichuris ovis.
Filaria lienalis.
Onchocerca gutterosa.
Onchocerca gibsoni.

PIG (*Sus scrofa*).

*Fasciola hepatica.
*Echinococcus granulosus.
*Cysticercus tenuicollis.
*Strongyloides sp.
Ascaris lumbricoides.
*Oesophagostomum dentatum.
*Oesophagostomum longicaudum.
Ancylostoma duodenale.
Necator americanus.
*Metastrongylus apri.
*Chærostrongylus pudendotectus.
*Hyostrongylus rubidus.
Stephanurus dentatus.
Arduenna strongylina.
Physocephalus sexalatus.
*Gnasthostoma hispidum.
Trichuris trichuira.
*Macracanthorhynchus hirudinaceus.

GOAT (*Capra hircus*).

Echinococcus granulosus.
*Moniezia expansa.
*Hæmonchus contortus.
*Oesophagostomum columbianum.
Trichostrongylus colubriformis.
Trichostrongylus extenuatus.

HORSE (*Equus caballus*).

Anoplocephala perfoliata.
*Anoplocephala magna.
Ascaris equorum.
Oxyuris equi.
Strongylus equinus.
*Strongylus vulgaris.
*Strongylus edentatus.
Trichonema tetracanthum.
Trichonema sp.
Dictyocaulus arnfieldi.
Habronema muscæ.
Habronema microstoma.
Habronema megastoma.

DOG (*Canis familiaris*).

Dypilidium caninum.
Echinococcus granulosus.
Tænia hydatigena.
Ancylostoma caninum.
Dirofilaria immitis.
Toxocara canis.

CAT (*Felis domestica*).

Diphyllobothrium mansoni.
Tænia tæniæformis.
Dipylidium caninum.
Toxocara mystax.
Ancylostoma caninum.

FOWL (*Gallus*).

Davainea proglottina.
Raillietina (Raillietina) tetragona.
Raillietina (Skrjabinia) cesticillus.
Hymenolepis carioca.
Hymenolepis inermis.
Amœbotænia sphenoides.
Ascaridia lineata.
Heterakis gallinæ.
Capillaria retusa.
Capillaria columbæ.
Oxyspirura parvovum.
Acuaria (Cheilospirura) hamulosa.
Acuaria (Dispharynx) spiralis.

PIGEON (*Columba livia*).

Aporina delafondi.
Ascaridia columbæ.
Ornithostrongylus quadriradiatus.
Capillaria columbæ.

DUCK (*Anas boschas domestica*).

*Echinostomum revolutum.
*Fimbriaria fasciolaris.

* Officially reported from these hosts for the first time in Queensland.

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TO SUBSCRIBERS—IMPORTANT.

Several subscriptions have been received recently under cover of unsigned letters. Obviously, in the circumstances, it is impossible to send the Journal to the subscribers concerned.

It is most important that every subscriber's name and address should be written plainly, preferably in block letters, in order to avoid mistakes in addresses and delay in despatch.

Improvement of Stock.

In the course of a recent statement to the Press, the Minister for Agriculture and Stock, Mr. Frank W. Bulcock, said:—

TO promote production, without increasing production costs, is an aim much to be desired. Recognising this, the Government has recently given consideration to methods whereby better results will be possible of attainment in relation to dairying, pig-raising, lamb-growing, and the production of heavy horses.

Present economic conditions indicate the need for more efficient means of production, and one of the best methods of attaining efficiency in production is by the use of stock selected because of some outstanding characteristic of economic importance. Hence, it follows that the employment of high-grade sires, representing as they do the head of the herd or flock, as the case may be, will add materially to our total wealth production, while at the same time benefiting the individual engaged in production.

In the scheme now approved by the Government there is an earnest desire to promote this efficiency in production, and it is recognised that many farmers do not employ indifferent sires because they desire to do so, but in consequence of an inability to buy more suitable stock.

In the case of the dairying industry, a greater volume of production from a small herd is possible, and in departmental experience has been often achieved. The advances now contemplated, which will be made through the Rural Assistance Board, will materially help dairy farmers generally to acquire a better class of bull.

Turning to beef, with the ever-increasing competition for available markets, and the undeniable fact that we must strive to attain the highest levels reached by our competitors, it is evident that some action to assist in providing good herd bulls is necessary. It is anticipated that cattle-growers will avail themselves of the opportunities afforded under the scheme.

From time to time complaints are raised concerning the decline of heavy horse standards, and in view of the fact that the future of the heavy horse appears to be assured, provision is made for assistance to purchase Clydesdale stallions, either individually or through groups.

The looked-for development of the lamb trade cannot take place until financial assistance is forthcoming, particularly for the purchase of rams of the British breeds.

The raising of pigs has also in recent years indicated clearly the need for the attainment of a high standard of quality.

Generally speaking, the proposals outlined in the scheme should make it possible for every live-stock raiser to possess a high-grade animal, which will soon reflect its characteristics in more efficient and, therefore, more economical production.

RURAL ASSISTANCE SCHEME.

Following are particulars of the rural assistance scheme:—

Dairy Sires.

(i.) Qualifications.—Advances to be made only in respect of bulls, either registered or eligible for registration in a recognised herd book, the progeny of dams which have qualified on a production basis.

(ii.) Valuation.—The limit of valuation shall be 20 guineas, plus 2s. per lb. butter-fat over the production standard to be placed on such bulls.

(iii.) Advance.—The total advance to be 75 per cent. of 20 guineas, plus 75 per cent. of the additional purchase price accruing in respect of production records.

(iv.) Term of Loan.—Maximum five years, an interest period of twelve months and a redemption period of four years.

(v.) Age of Bull.—Nine months to five years; provided that in special cases the Board may approve of an older animal.

(vi.) Security.—Stock mortgage, assignment, or such other security as the Rural Assistance Board may require.

(vii.) Health.—T.B. test to be carried out in respect of bulls over two years of age. C.A. test to be at the discretion of the Minister.

(viii.) Group Purchases.—Any such applications received to be dealt with on their merits by the Rural Assistance Board.

Sheep.

To encourage the early lamb industry advances may be made for the purchase of up to 100 merino ewes and two rams of British breeds. In the case of established flocks, advances may be made for the purchase of up to ten British-breed rams (on a 2 per cent. basis). The valuation of rams to be 50 per cent. of 5 guineas, plus 50 per cent. of freight. The basis of advance to be 50 per cent. of landed cost. The loan to be for a maximum of four years, an interest period of twelve months and a redemption period of three years.

Security.—Stock mortgage and wool lien, if practicable. In particular cases the security to be at the discretion of the Rural Assistance Board.

Beef Bulls.

Qualification.—Bulls to be registered or eligible for registration in recognised stud book, or the progeny of registered bulls from pure-bred cows.

Valuation.—Maximum of 75 guineas per bull. Maximum advance 150 guineas, or in special circumstances advance to be at the discretion of the Rural Assistance Board.

Advance.—Seventy-five per cent. of landed cost.

Term of Loan.—Maximum five years, interest period one year, redemption period four years.

Security.—Stock mortgage or such other security as may be required by the Rural Assistance Board.

Age of Bulls.—One year to three years.

Health.—T.B. test to be conducted in respect of bulls over two years. C.A. test to be at discretion of Minister.

Stallions.

Qualifications.—Advance to be granted in respect of Clydesdales only, approved by the Stallion Board.

Advance.—Fifty per cent. of cost, and such advance shall not exceed £150.

Term of Loan.—Maximum five years, interest period one year, redemption period four years.

Age of Stallion.—Three to five years, provided in special cases advances may be made for older or younger animals at the discretion of the Board.

Security.—Stock mortgage and insurance. Applications are to be considered on the basis of suitability and requirements of a district.

Group Purchases.—Similar conditions in respect of stallions as defined in respect of the individual are to apply to group purchases, but in which case personal guarantees may be required from the group or the show committee for security.

Boars.

Qualifications.—Advances to operate in respect of Berkshires, Tamworths, Large and Middle Whites, registered or eligible for registration in a recognised herd book.

Advance.—Fifty per cent. of landed cost, such advance not to exceed £7 10s.

Term of Loan.—Maximum two years, interest period six months, redemption period eighteen months.

Age of Pig.—Four months to two years.

Security.—Stock lien or such other security as may be required by the Rural Assistance Board.

An application fee of 5s. will be required in respect of applications under the scheme.

If an applicant should buy a sire, stallion, ram, or boar above the maximum valuation shown, he will be required to defray the excess amount. The Board will advance 50 per cent. or 75 per cent. only on the valuations shown in the foregoing.

THREE-HORSE TACKLE.

The diagram of three-horse tackle is designed to do away with two swingle-trees. A rack is furnished in the middle of the main swingle-tree to alter the leverage, if necessary. The rest of the arrangement is plain to a practical man.

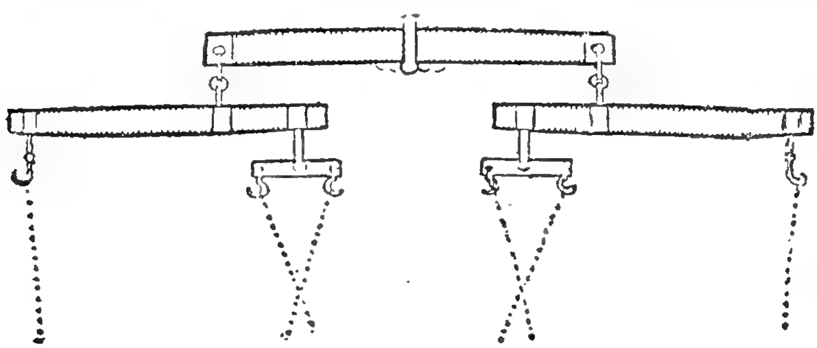

PLATE 75.

Harvesting Cotton.

By R. W. PETERS, Cotton Experimentalist.

THE harvesting of cotton is one of the important operations connected with the production of this crop. Not only is it the most expensive item, the total cost per acre amounting, when good yields are obtained, to as much as £7 sterling on a piece rate per lb. basis, but the way in which the crop is harvested has a decided effect on the quality of the resultant lint produced. Investigations in the United States of America have shown that the fewer cleanings cotton receives during the ginning operations the less damage will be done to the fibres. It has likewise been shown in England that the fewer cleaning operations the fibres have to be subjected to in the spinning processes the better suited they will be for the economical production of yarn of high quality. It can be appreciated, therefore, that the harvesting of a cotton crop should be done carefully, and every factor adversely affecting the quality of the lint should be guarded against.

Picking Cotton.

One of the most important points to observe is not to pick cotton either when it is wet from exposure to rain or when it is green, as fibres are called before the bolls have been open long enough to let the fibres dry out thoroughly.

Not only is it difficult to clean leaf and trash out of cotton in either condition, but during the ginning operations the saws cut the wet fibres very badly, and also tend to leave them in a twisted, ropy state. Lint of this nature is easily detected, and the buyers penalise it heavily, for much waste is obtained from such cotton during the spinning operations. Wet cotton is difficult to gin, and in some types of ginneries it interferes with the delivery of the lint from the saws to the bale press. In the wetter districts of the United States of America it has been found necessary to devise special apparatus to dry the seed cotton before ginning, and the quality of lint obtained from cotton treated in such manner is raised at least a whole grade. In most seasons in Queensland no difficulty should be experienced with wet cotton, for the usual climatic conditions are suitable for the harvesting of dry cotton after the dew has evaporated. Where picking is done while the dew is still present the wet cotton should be spread out in the sun during the forenoon, after which it can be baled with the rest of the picking of the day. It is not necessary to dry the cotton which is picked after the dew is off, providing "green" cotton is not included.

In the earlier years of the present phase of cotton-growing in Queensland, the ginneries were equipped with cleaning apparatus which was not as efficient as that now installed, and it was necessary to pick the cotton rather cleanly in order to obtain high-grade lint from it. As the premiums between grades were then fairly large most growers endeavoured to send in clean cotton, and this tended to slow up the rate of picking. With the present more efficient machinery it is not necessary to have the cotton as nearly "snow-white" as many growers used to send it in order to obtain the best grades. This is particularly true where the farmer and his family pick the crop, and it is suggested in

such cases that it would be better to pick the cotton slightly less cleanly, and therefore more quickly, for not only could greater tallies be obtained in the time available each day for harevsting the crop, but larger acreages could be grown and still be harvested without employing labour.

In this respect it is pointed out that in a normal season in cotton picked prior to the occurrence of heavy frosts, the bracts and pieces of leaf are fairly tough and pliable, and do not break up into small pieces as happens after they become brittle from the effect of frosts. Early picked cotton can thus contain a fair amount of big leaf and still yield lint of high grade, for the cleaning machinery removes the big leaf without breaking it to any extent. It is a mistake, therefore, either to pick so carefully as to have little leaf or, worse still, to roll the cotton between the hands to break up the large leaf. It is the small pieces of leaf which are difficult to remove, and seed cotton containing fine pieces, or "pepper" leaf, as it is termed, have to be graded lower than cotton with big leaf. This is the reason the grades usually drop off after heavy frosts occur—the dead leaves and bracts are so brittle that they break into small pieces when picked with the cotton, and while the improved cleaning machinery eliminates the major portion of them it is impossible to remove all, hence the necessity of grading the seed cotton lower than if the pieces of leaf were large and not brittle.

PLATE 76.—COTTON CROP FULLY OPENED.

Cotton in this condition should not be left for any length of time, for exposure to the elements may result in serious damage and general deterioration of the crop.

The most difficult matter to remove from the cotton lint is grass and weed seed, especially spear grass seed, and every effort should be made to clean the fields at the last cultivation so that no seed will be produced. On old cultivations, even where good farming practices have been followed, there is always danger of tall-growing weeds in the rows setting seed late in the season, and it pays to chop out such weeds before the harvesting commences, especially if pickers are employed.

Preserving the "Bloom" of the Crop.

Another important point when harvesting cotton is to guard against leaving the cotton exposed too long to the weather. Cotton, when the bolls first open, has a nice richness of colour, or "bloom," as it is termed, and it is necessary for a sample of cotton to have this "bloom" before it can be graded into the higher grades of the regular universal standards, although it may be free of trash. When cotton is left unpicked for several weeks the bloom is lost through the bleaching action brought about by the nightly wetting of the dews and the subsequent drying by the sun. This changes the colour to a chalky dead-white and also destroys the lustre of the fibres. The effect of storms on cotton is worse than the dews—the colour changes to a dull greyish tinge, and even to a light bluish tinge when rains lasting several days are experienced. When rains do occur cotton should not be picked for several days, for the bleaching action of the dews and sun greatly improves the colour, while wind and heat fluffs out the fibres from the matted condition caused by the rain. This greatly improves the appearance of the lint, and raises both the lint and seed cotton at least a half-grade. The grower thus benefits in two ways by delaying picking after a storm until the cotton has improved in appearance. The cotton is of more value, and no payment is made for picking moisture.

Effect of High Winds.

Another reason for not delaying the picking of cotton too long is the effect of winds on a well-opened crop. With the continuous movement of the plants in windy weather the locks tend to hang out of the bolls in a long, stringy condition. This not only allows the cotton to dry out excessively, thus losing weight and adversely affecting the character of the fibres, but also makes the cotton difficult to gin properly, owing to a considerable proportion of the locks being in a twisted, rope-like condition. Cotton left exposed to windy weather also usually gathers up bits of broken bracts and leaves, especially if severe frosts have occurred. It is difficult to clean such trash in the ginneries, for the smaller pieces are generally twisted in amongst the fibres. In addition to these disadvantages, much greater loss of crop onto the ground occurs in heavy storms in wind-blown cotton than where picking is done at proper intervals. It can be appreciated, therefore, that the opened crop should not be left unpicked too long. Where the harvesting is done by the grower and his family it will pay to make several pickings in a good crop, depending on the season. Where labour is employed it has to be remembered that sufficient bolls must be open to allow the picker to make a reasonable tally, otherwise the cost of picking will necessarily be higher. Generally speaking, it has been found satisfactory when employing labour to make one good picking and then a clean-up in fields of light to medium yield, and two pickings and a clean-up in good crops. The grower should be guided by the conditions as they exist. Sometimes it is better to allow a heavy picking to open and thus get it picked cheaper than if a lighter picking was made, and cotton of a higher quality obtained.

Snapping.

Cleaning machinery is now installed at the Glenmore and Whinstanes ginneries for treating snapped cotton. Snapped cotton is obtained by snapping or jerking the whole burr and contents from the plant, and should be practised only after heavy frosts have been experienced.

The method originated in sections of the United States of America during a season of labour shortage, and the cheaper harvesting costs obtained quickly brought about the general use of the system, especially in places and seasons with high picking rates and early killing frosts. Cleaning machinery was soon evolved to remove the burrs, extra leaf, and parts of the plant gathered in the snapping operations. Undoubtedly the method is of decided value under many conditions, and especially so in Queensland in harvesting the top crop. It is pointed out, however, that snapping should not be substituted for picking cotton that has not been well frosted. Snapping unfrosted bolls tears the plant badly, and the cotton when packed in containers for forwarding to the ginnery "sweats" so that it is difficult to clean and gin. In addition to this, freight is paid for green, wet burrs, leaves, and portions of the plant instead of light, dead material. Snapping mature cotton undoubtedly lowers the grade to the point where the full value of the lint cannot be obtained. On the other hand, snapping the top crop of bolls, which usually contain cotton of the lower grades not only does not lower the grades materially, but enables a considerable amount of cotton to be harvested cheaply which would often not have been picked. Only bolls containing marketable cotton should be snapped, however. During this past season a considerable percentage of dry, hard, diseased bolls, or "hickory nuts," as they have been termed, were forwarded in the late snapped cotton. As these contain no cotton and are removed in the cleaning machinery before the seed cotton is weighed, the grower pays the pickers for nothing of value, and the Cotton Board pays unnecessary freight, thereby reducing the amount of the later payments. Snapping is of value to Queensland cotton growers, but should be used properly.

Packing Cotton.

Owing to the distance of the cotton fields from the ginneries in Queensland the crop is forwarded by train either in bags or wool packs containing around 80 to 100 lb. and 500 lb. of seed cotton, respectively. The growers of small acreages generally use second-hand corn bags, &c., while those with more than 5 or 6 acres usually purchase once-used wool packs for their crop. It is cheaper to use the wool packs, for grower's individual ones are returned for a small fee which covers cost of freight and heating to kill the pink boll worm or any cotton pests in them.

Clean Containers Necessary.

It is pointed out that before filling a container it should be cleaned carefully to remove everything that might affect the grade of the cotton, and wool packs which have had cotton in them should be especially cleaned in order to protect the purity of seed. Growers should pay particular attention to this feature, for undoubtedly much contamination of pure seed varieties can be brought about by the admixture caused through bits of seed cotton sticking in the corners of bales and attached to strands of the sewings along the edges, &c.

Uniformity of Grade in Every Bale.

When packing a container every care should be taken to have only the one grade and staple of cotton in it. A bale of lint is sold on the basis that it contains cotton of uniform grade and staple length. If there is any variation of content encountered it is purchased on the basis of the lowest grade and shortest staple contained. It is necessary,

therefore, for the growers to assist in every way possible in obtaining uniformity of contents of the bale of lint. Where cotton is forwarded in bags the extra sampling done in determining the value of sufficient cotton to make a bale of lint and the better mixing of the small lots, enables uniform bales to be ginned. Very careful mixing has to be done of some wool packs received, however, owing to the layers of cotton of different grades pressed in them. Many large growers have the pickers empty their picking sacks directly into the wool pack, and where this is done layers of markedly different grade often result, owing to some pickers picking trashy cotton. It is recommended that the contents of each bag should be roughly graded by the grower and an endeavour made to segregate the different grades in his cotton into separate wool packs. The grading at the ginneries could then be done more quickly, in that it would not be necessary for the grader to stop and estimate the true value of a wool pack owing to the different grades of seed cotton contained in it as is now frequently done, and in addition more uniform cotton would be fed to the gins, thus enabling the production of bales of lint containing only one grade in each.

It is most important that growers should pay more attention to forwarding containers with uniform contents, and it is strongly recommended that some effort be made to grade the cotton before putting it into wool packs, and blending before putting it into bags. Usually two and in some fields three grades would be ample, for with the exception of droughty spots or places of rank growth, the quality of the crop over a field, if picked in a short time, is more or less the same. By having a bale each for good grade, leafy cotton, and cotton which is insect stained or from droughty spots in the field, a grower, especially with a large acreage, would not only obtain the full value of his crop, but would be forwarding containers of uniform contents, thereby assisting the industry generally.

Forwarding Cotton.

Every grower has a registered number, and should include this with his initials and railway station in a brand for identifying each container he sends. The brand should be placed in a conspicuous place on the side of the container in black that will not rub or wash off. Each season a number of wool packs are received at the ginnery which have no identification marks, or the brands are so indistinct that they are not legible, and it is only through checking up the advice notes which a grower despatches to the Cotton Board when forwarding his cotton, that the ownership can be established. This slows up the work at the ginnery and should not occur, for it is a simple manner to brand the cotton carefully.

Grading.

When the container of seed cotton arrives at the ginnery the contents are examined by a grader, who first determines the grade. "Grade" means a combination of the colour, body, and strength of the cotton and the amount of trash or foreign matter in it. The grades used in grading seed cotton are based on the Universal Standards for American cotton, which are recognised in all official cotton exchanges. The grader then determines the length of the fibres, or staples it, as the operation is termed. Each container is then weighed and check-weighed and checked against the amount of cotton the grower states on his advice note he is sending to the ginnery; after which it is segregated into the proper

stack for ginning according to the grade and staple. When the cotton is being ginned two samples are drawn from each 500-lb. bale of lint in such a way as to represent the true contents. These are labelled and sent to the classing room where another grader grades and staples them under an even light. Each bale is classified against a set of lint standards based on the key set of Universal Standards for American cotton that are obtained from the United States Department of Agriculture every time new reference sets are made. The true contents of each bale of lint are thus known, and also the grade and staple of each container of seed cotton from which the bale of lint was obtained. This enables the grader of the seed cotton to check on his classifications throughout the season and thus ascertain if the seed cotton is producing lint of the quality he has estimated.

The grower can thus see that every care is being taken to prepare his produce so that the full value will be obtained for it. Being graded on the accepted Universal Standards it can be readily sold in any cotton consuming country. As acclimatized seed of suitable varieties is supplied through a scheme of seed development controlled by the Department of Agriculture and Stock, the grower has the means of producing cotton of high quality, and it has been thoroughly demonstrated that where proper cultural systems are carefully followed the Queensland cotton grower can produce an article which is satisfactory in all respects.

PIPE WRENCH.

When a large pipe wrench is needed, but not available, one can be quickly improvised by using a small wrench in connection with a chain, as illustrated. The

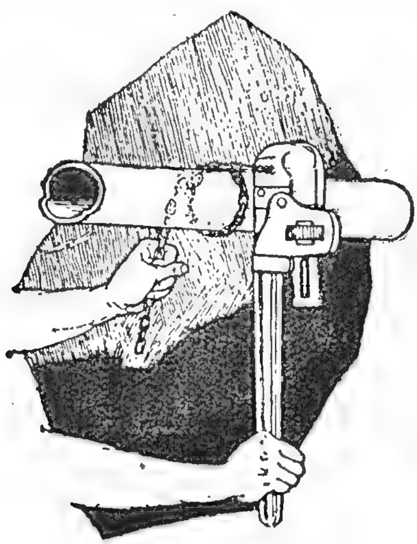

PLATE 77.

chain is wrapped around the pipe, one end is gripped in the jaws of the wrench, and the other held in the hand. Pulling on the wrench tightens the chain so that the pipe can be turned.

Pasture Requirements and Composition.

By E. H. GURNEY, Agricultural Chemist.*

THE wealth of the Australian Commonwealth is largely derived from primary products, and particularly is this the case in the State of Queensland. These primary products are dependent on pasture growth; in fact it has been stated that more than three-quarters of the monetary value of Queensland's exports is derived from glasslands.

From this it will be seen how important it is that all information obtainable regarding pastures should be utilised in order that greater production of all primary products be attained, and that at the lowest cost.

That extensive research work is required in connection with the pastures of Queensland is well known, but mention should be made that information of economic value regarding some of these pastures has been obtained and widely published and that, although some have made use of such information in their pasture management, many owners of similar pasture have not. This matter will be referred to later.

That some attention was paid to pasture in early times will be seen from the following interesting extract taken from an article—"The History of Pasture Analysis," by William Davies[1]:—

> "Worlidge[2] in his "Systema Agriculturæ: the Mystery of husbandry" (1687), considers at some length the management of pastures and refers to the sowing of ray grass (= perennial rye grass), St. Foyn (Sainfoin), and la lucerne (=lucerne) for the purpose of providing hay and fodder. He makes no reference whatever to specific examination of the resultant herbage crop. Similarly, Marshall[3] (1788), refers to methods for improving grasslands, but makes no suggestion relative to herbage analysis. Sinclair[4] (1824), provides valuable information regarding the leading grassland outlook of his day. His own work, together with that carried out in collaboration with Sir Humphry Davy, lays the foundation for combined agronomic and chemical studies on individual British grasses and clovers."

From this it is seen that pasture has been studied from early times, but from about the beginning of this century what may be termed a special detailed pasture investigational period has occurred, and that such pasture study has been world-wide, covering humid to arid climatic conditions.

During the later period mentioned there have been, no doubt, a number of reasons for the particular interest taken in grass study, but the main reasons, it is considered, have been the importance of making practical use of the fact that great variation in composition of grass occurs at different stages of growth, and that when the feed-value of grass is being considered the amount and composition of its mineral content has also to be taken into very definite account.

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* In a radio lecturette from Station 4QG.

Before describing the variation in composition of some of our grasses, brief mention may be made of the functions of some of the food ingredients—e.g., proteins, fibre, and mineral matter—contained in grasses and other feeding stuffs.

Proteins are complex nitrogenous bodies existing in grasses and foodstuffs, and are used by animals for building up the proteins contained in the muscle, flesh, and blood of their bodies. For the purpose of making flesh, &c., the young growing animal will require a relatively large amount of protein in its feed, whilst the mature animal requires the protein for repairing waste in the body, and particularly is an extra supply of protein required by an animal producing milk.

Some quantity of fibre in foodstuffs is useful in giving bulk to the food and in aiding to a certain extent digestion. Different animals require different amounts of fibre in their rations. The digestion and evacuation of fibre necessitates the use of some energy by the animal; therefore the extent to which fibre in any foodstuff is digestible is of importance.

Mineral matter is required by the animal for bone formation, in maintaining the normal condition of blood and other body fluids, and particularly in mineral matter required by animals producing milk.

The more recent work upon grass and grassland has shown that malnutrition of stock is caused, in many cases, by insufficient or improperly balanced mineral matter in the grass feed, and that even when distinct evidence of malnutrition is not apparent that low production or ill-health may be caused by some mineral deficiency.

A few examples showing the difference in composition of plants at different stages of their growth will now be given, but it must be understood distinctly that all the figures quoted are calculated upon the analyses of "water-free material" contained in the plants.

—	Water-free Material.				Remarks.
	Crude Protein.	Crude Fibre.	Lime.	Phosphoric Acid.	
Paspalum ..	20·6	23·7	·41	·61	Short young grass
Ditto ..	5·7	35·2	·54	·33	Old stemmy growth
Rhodes grass ..	16·4	27·1	1·19	·72	Young leafy grass
Ditto ..	5·8	33·3	·58	·60	Old stemmy growth
Mitchell grass ..	17·1	30·9	1·0	·53	Young
Ditto ..	8·76	39·7	·56	·49	Midgrowth
Ditto ..	4·02	43·4	·46	·24	Mature
White clover ..	29·9	16·9	1·56	1·18	Young leafy growth
Ditto ..	18·1	22·1	2·07	·52	Old growth
Lucerne ..	29·4	17·0	1·97	1·01	Young preflowering growth
Ditto ..	18·4	32·6	3·54	·67	Old mature growth
Phalaris tuberosa	25·9	19·6	·50	·34	Short young grass
Ditto ..	10·8	27·7	·81	1·13	

These figures are not the extreme limits of variation in composition that may occur in plant growth, for in the very young growth of a number of forage plants a protein content of 33 per cent. and more occurs, whereas, on the other hand, in old matured growth, such as

grass roughage, the crude protein content may be about 1 per cent., together with less than on-tenth of 1 per cent. of phosphoric acid.

That young pasture growth has a very high feed value and is in a digestible condition has been stated in many publications, but it is considered that this fact has not had the practical recognition in Queensland that its value deserves.

In our climate, owing to most of the seasonal rain falling during the warmer months of the year, a very prolific and rapid growth of grass ocurs. A very large proportion of this flush growth in the younger and highly nutritious stage is not consumed by stock, but continues to grow to maturity and ultimately becomes roughage of more or less low feed value. Thus it is that a large amount of highly nutritious foodstuff is not made use of, and it is important that serious consideration should be given by all stock owners to methods for the economical use of such valuable foodstuff. Suitable methods for the utilisation of young paspalum growth have been established and put into practical use with success by at least some owners of dairy stock in Queensland.

It has been demonstrated that after mowing and removal of roughage followed by treatment with suitable "renovators" even old established paspalum pasture will give heavy yields of fresh young growth when fertilized with 1 cwt. of ammonium sulphate and 2 cwt. of superphosphate per acre. This young growth may be utilised by a system of "rotational grazing," or by repeated mowings harvested, and conserved as hay or ensilage.

The fertilizing of grass and feeding-off in the young stages of growth is of particular value when the soil is deficient in phosphoric acid, and a large number of our coastal soils have a poor phosphoric acid content. The fertilizing of these pastures also induces increased clover growth which, as mentioned before, when young has a very high lime and phosphoric acid content.

The best results from all grass varieties may not be obtained by a method of repeated mowings or intensive grazing. Experiments with Rhodes grass dealing with this matter are being conducted.

In the case of Mitchell and Flinders grass, the making of hay with these grasses, when not too matured, would appear to be the most suitable method for the conservation of a certain amount of flush growth. Very fine samples of sweet smelling Mitchell and Flinders grass hays have been analysed and found to contain relatively high amounts of protein and low fibre.

From what has been said it is apparent that young grass growth is material of high feed value, and as it is produced upon the farm or holding it is cheaper than bought foodstuff of equal food value, and failure to make the most use of it means loss of profit.

Mention has not been made in connection with some different methods of pasture improvement, such as the introduction of the best grass strains and legumes into some of our grasslands, but it is generally recognised that such improvements would be of very great economic value.

Reference has mostly been made to the high food value of young grass growth, but it is considered that some stock owners place too much reliance upon the feeding value of old matured grass. It should

be fully recognised that this dependence upon old grass will result in lower production by all kinds of stock, particularly in the case of introduced high-grade stock, and in many cases through malnutrition will cause the stock to become liable to disease.

REFERENCES.

1. William Davies, "The History of Pasture Analysis," from "Agricultural Progress," Vol. X., 1933.

2. J. Worlidge, "Systema Agriculturæ; The Mystery of Husbandry."

3. Wm. Marshall, "The Rural Economy of Yorkshire."

4. G. Sinclair, "Hortus Gramineus Woburnensis."

QUEENSLAND SHOW DATES, 1934.

March.

Allora, 7th and 8th
Clifton, 14th and 15th
Millmerran, 20th
Tara, 21st
Goombungee, 28th
Boonah Camp Draft, 31st March and 2nd April

April.

Pittsworth, 4th and 5th
Warwick, 10th to 12th
Toowoomba, 16th to 19th
Rosewood Camp Draft, 7th
Goondidwindi, 27th and 28th
Oakey, 28th
Taroom Camp Draft, 30th

May.

Taroom, 1st and 2nd (Camp Draft, 5th)
Dalby, 3rd and 4th
Beaudesert, 2nd and 3rd
Nanango, 3rd and 4th
Blackall, 7th to 9th
Chinchilla, 8th and 9th
Charleville, 8th to 10th
Crow's Nest, 9th and 10th
Boonah, 9th and 10th
Monto, 9th and 10th
Kingaroy, 10th and 11th
Ipswich, 15th to 18th
Miles, 16th
Kilkivan, 16th and 17th
Mitchell, 16th and 17th
Mundubbera, 16th and 17th
Dirranbandi, 16th and 17th
Wondai, 17th and 18th
Roma, 22nd to 24th
Gympie, 23rd and 24th
Emerald, 23rd and 24th
Biggenden, 24th and 25th
Murgon, 24th to 26th
Toogoolawah, 25th and 26th
Kalbar, 26th
Goomeri, 29th and 30th

June.

Maryborough, 1st, 2nd, and 4th
Marburg, 1st and 2nd
Childers, 5th and 6th
Gin Gin, 5th and 6th
Bundaberg, 7th to 9th
Lowood, 8th and 9th
Bororen and Miriam Vale, 11th and 12th
Wowan, 14th and 15th
Rockhampton, 19th to 23rd
Mackay, 26th to 28th
Laidley, 27th and 28th
Proserpine, 29th and 30th
Townsville Rodeo, 30th

July.

Bowen, 4th and 5th
Gatton, 4th and 5th
Kilcoy, 5th and 6th
Ayr, 6th and 7th
Townsville, 10th to 12th
Woodford, 12th and 13th
Rosewood, 13th and 14th
Cleveland, 13th and 14th
Cairns, 17th to 19th
Charters Towers, 18th and 19th
Caboolture, 20th
Nambour, 18th and 19th
Atherton, 24th and 25th
Pine Rivers, 27th and 28th

August.

Royal National, 6th to 11th
Home Hill, 31st August and 1st September

September.

Enoggera, 1st
Imbil, 7th and 8th
Ingham, 7th and 8th
Innisfail, 14th and 15th
Beenleigh, 20th and 21st
Mareeba, 20th and 21st
Rocklea, 22nd
Malanda, 26th and 27th
Kenilworth, 29th

October.

Millaa Millaa, 5th and 6th
Tully, 12th and 13th

The Pig Farm.

ACCOMMODATION AND EQUIPMENT.

By L. A. DOWNEY, H.D.A., Instructor in Pig Raising.

The lively interest taken in progressive pig raising in Queensland in recent years has led to an increased demand for information on the layout and equipment of modern piggeries. Articles on the subject have been published in this Journal from time to time, the last one appearing in our issue for August, 1932. This paper, besides being a revision of former articles by the same author, contains much new material, including plans of pens and a portable shelter prepared by the Public Works Department from sketches supplied by the Pig Branch, and which should be very useful to farmers contemplating improvement of their piggery accommodation, as well as to others about to enter the pig-raising industry.—ED.

ALTHOUGH the pig is a fairly hardy animal it is, in these days, more than a scavenger, it is a pork-producing machine which is kept by the farmer to convert certain foods into edible pork, the farmer's object being to have his pork-producing machine working at the highest degree of efficiency—that is, he wants to have his pigs growing rapidly on the least amount of food and producing good quality meat. Of course, breeding and feeding are two important factors in pork production, but accommodation and management are equally important; the pork machine cannot function efficiently unless it is well cared for. In our comparatively mild climate there is no need for elaborate housing for pigs, as is the case in some colder climates, but still the pig should be provided with sufficient shelter from the extremes of the weather.

Where pigs are kept as a side line on the farm, their accommodation is sometimes very neglected, but there is no good excuse for this, for even when there is little money available for building the piggery, it can still be built along proper lines provided a little thought is given to the planning of the yards, sheds, and paddocks; if not well planned but just allowed to grow, the piggery will become a muddle. The old idea that the piggery was a dirty and objectionable place has now disappeared and the pig is given his rightful place on the farm either in a nice grassy run or in a well-kept concrete pen.

Speaking in a broad way, it may be said that there are only two satisfactory methods of keeping pigs, one is on pasture, and the other is in concrete pens, anything between these two systems such as a bare earth sty or yard is unhygienic and therefore unsatisfactory. Every pig raiser should decide whether his conditions are most adapted to paddockings pigs or penning them on the intensive system.

The grazing of pigs either on permanent pasture paddocks which can be grazed and spelled in rotation, or on crop paddocks where a succession of forage crops can be provided and the soil cultivated periodically, has many advantages—the pig lives in a natural condition and is contented, it has a healthy atmosphere and abundant sunlight which tends to promote health in the animal. If the grazing is good, the

pigs will obtain a portion of their food and may be encouraged to do their own harvesting, thus saving labour. When pigs are grazing there is little risk of them suffering from mineral or vitamin deficiency. Rotational grazing and cultivation of pig paddocks is one of the most practical means of controlling worm infection in pigs which threatens to become a serious problem in pig production. The present requirements

Plate 78.
A well-planned piggery at Dalby with intensive pens and a number of grazing paddocks provided with Pepperina trees for shade.

of the pork and bacon trade are for lean meat, and it is easier to produce lean, fleshy porkers and baconers if they are grazed than if they are confined in small pens. Most agricultural and dairy farm piggeries can be conveniently laid out for paddocking pigs, and the best plan is to have three or more small paddocks of half an acre or more each which can be ploughed at any time.

Some pig farms, such as buttermilk piggeries, slaughter-yard piggeries, and suburban pig farms, are not suited for grazing pigs, and so in such places the intensive system of housing is recommended. On these places large numbers of pigs are kept on comparatively small areas and for sanitation it is necessary that they should have impervious floors such as concrete with a wooden section to camp on.

After having decided on the class of pig accommodation to suit the particular conditions, the farmer should survey the extent to which the pig section of the farm may grow, and then plan the whole undertaking on a definite system. He should estimate the number of breeding sows he is likely to run, and the room required to accommodate them and their progeny up to porker or baconer stage.

The amount of land required for grazing pigs will naturally depend on the climate, the class of land, whether it is cropped with heavy-yielding

crops or grassed, and the nature and amounts of other foods available for the pigs. Pig pasture paddocks should be rested from the pigs or cultivated when they begin to get bare, so they should be sufficiently subdivided to allow of rotational grazing. In subdividing pig paddocks, it is an advantage to make the runs long and narrow so that by the use of a short length of temporary fencing a portion of the paddock can be partitioned off for the stock to graze on, and when this is cleaned up the temporary fence may be moved to give the pigs a fresh piece of the crop.

Adjoining the pig paddocks there should be a lane leading to a loading race to provide for convenient loading of the pigs.

PLATE 79.
Pigs give best results when run on good pasture.

Where pigs are grazed in paddocks, movable equipment such as sheds and troughs will be found most convenient in all but very hilly country. The sheds and troughs may be built on skids for easy transport by a horse team or tractor. The advantages of movable equipment over stationary sheds and troughs are that, when pigs are being concentrated in one particular paddock to feed off a crop, sufficient sheds and troughs may be easily taken with them; also when the ground around the troughs and sheds becomes fouled, as it does after a time, they may be shifted and the ground allowed to sweeten. Where permanent troughs are built in pig paddocks they should be made of concrete and be built into a concrete floor which can be drained and kept clean.

When given a good paddock and plenty of food pigs do not as a rule try to break through fences, and it is a rule that the larger the paddock the lower and less substantial the fence required to keep the pigs in. The many types of woven wires and barbed wire make good pig paddock fences. If there is any natural shade in the runs the pigs will only require the shelter of the sheds in extreme weather, and therefore the sheds need not be elaborate or expensive.

The size of the sheds or huts required in the paddocks will depend on the number and class of pigs it is desired to house, but a useful size is 8 feet by 8 feet floor space and the roof should be about 6 feet from the floor so that a man can easily work inside the shed and so that the pigs may keep cool in them on a hot day. With a floor 8 feet by 8 feet there is ample room for a sow and litter or for about ten growing pigs. The class of material to be used in the construction of the sheds will depend on their availability and cost. The floor should be set on two strong skids, which not only keep the floor boards dry, but also provide for easy transport of the shed.

For intensive housing of pigs the camping shed can be built the same as the shelter shed for paddocked pigs, but there should be a small run adjoining which has a sloping concrete floor and a good drain; a reliable water supply should be provided at such piggeries so that the pens may be washed and kept in a sanitary condition. The troughs in the intensive pens may be movable or they can be of concrete built into the floor. Where practicable the pigs sheds should be so placed that the early morning sun rays will penetrate right inside as the sun is a good and cheap disinfectant. The front of the shed should be at least partly open to allow the sun rays entrance.

Legislation.

Pig raising is controlled by legislation under the Pig Industry Act, Dairy Produce Act, Diseases in Stock Act, and the Slaughtering Act, and the by-laws of city, municipal, and shire councils. While it is advisable when about to construct or alter a piggery, to consult the authorities concerned, through the district inspectors under the Acts, it might be stated here that the general purposes of the legislation in force are to provide for health and sanitation on the premises where pigs are kept. They do not aim at hindering progress or at increasing the cost of production.

Situation.

In selecting a site for the piggery, consideration should be given to the aspect so as to provide shelter from the prevailing winds, and to make the best use of the early morning sun as a disinfectant and deodoriser inside the sheds; thus a north-easterly aspect will usually be found the most suitable for pig accommodation.

It is an advantage to have the pig paddocks on a slope to provide surface drainage. It is required by the Dairy Produce Act that the piggery should be situated at least 150 feet from dairy yards and buildings. Where separated milk is to be used for pig feeding, the farmer should endeavour to have the piggery and dairy so situated that the separated milk may be conveyed in a line of open fluming from the separator-room to the piggery so as to save unnecessary labour which would otherwise be involved in carrying or wheeling the milk to the pigs.

The available water supply, shade, and proximity to cultivation land are other points to be considered.

A Suggested Layout.

The plan of a piggery shown in Plate 80 suggests a layout which has proved very satisfactory where suitable cultivation or grazing land is available. This plan gives scope for cultivation and rotational grazing

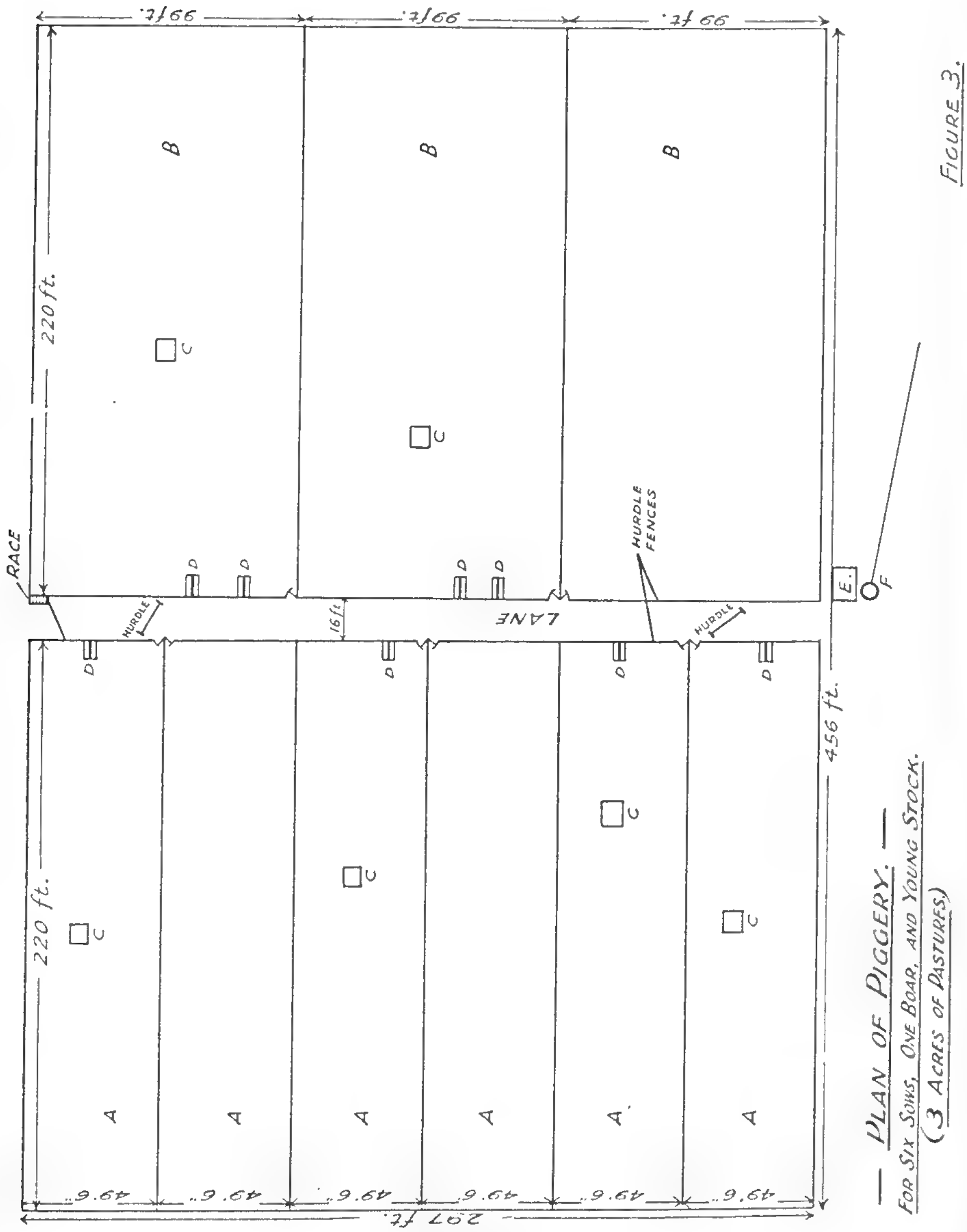


PLATE 80.

(*a*) Indicates paddocks of $\frac{1}{4}$ acre each for the use of dry sows, sows with litters, and the boar. At most times two of these paddocks could be under cultivation and later be grazed in rotation.

(*b*) Indicates paddocks of $\frac{1}{2}$ acre each in extent to be used for growing pigs. As one paddock could usually be spared they can be cultivated and grazed in rotation.

Six movable sheds (*c*) should be sufficient shelter for the pigs, as these may be moved from one paddock to another as required.

Troughs built on movable platforms (*d*) will be found convenient if drawn against the fence and moved along as the surrounding ground becomes fouled.

(*e*) Shows the feed shed.

(*f*) Shows the milk tank connected by a line of fluming from the separator-room.

of paddocks with a view to providing a maximum of pasture for the pigs and control of disease and parasites. The lane in the centre of the runs with a loading race at one end and two movable hurdles provides ample facilities for drafting pigs.

The usual fencing should be replaced by movable hurdles at the ends of the runs adjoining the lane so that when paddocks are being cultivated implements may work right to the end of each run, for it is this portion around the troughs which becomes most fouled.

All sheds and troughs should be constructed on skids so that they may be moved when required to keep the runs in a sanitary condition.

It is not suggested that pigs will obtain all their food from the three acres of grazing shown in this plan, and the grazing can only be expected to carry the pigs if other foods such as grain and milk or grain and meatmeal are provided in addition.

Where the correct type of pig is bred and feeding conditions are good, pigs may be kept in paddocks, as suggested, from birth to slaughter with excellent results.

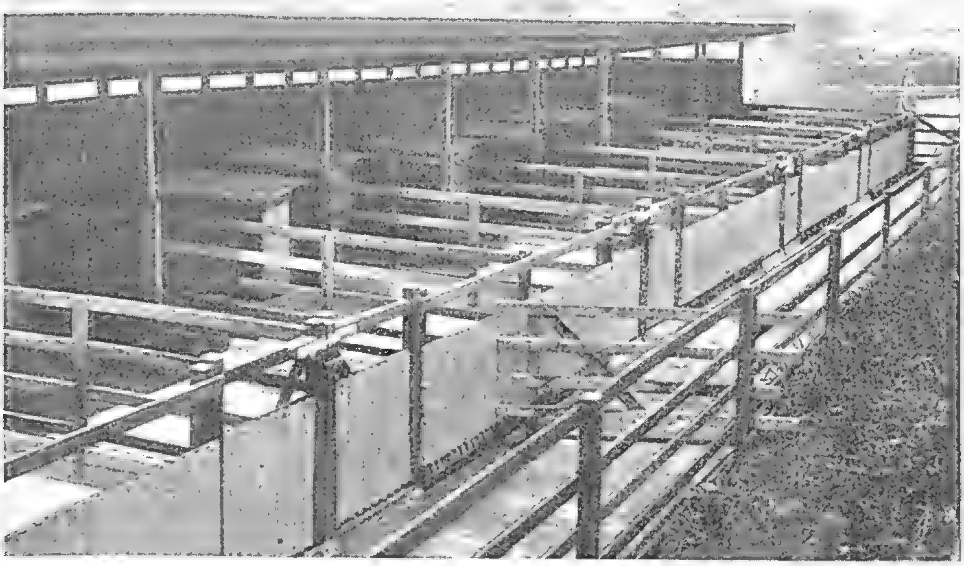


PLATE 81.
Intensive pig pens in use at the Animal Health Station, Yeerongpilly.

Quarantine Pen.

It is advisable to provide a quarantine pen some distance from other pens, where newly-introduced pigs and sick pigs could be placed and kept under observation. This is an important safeguard against disease.

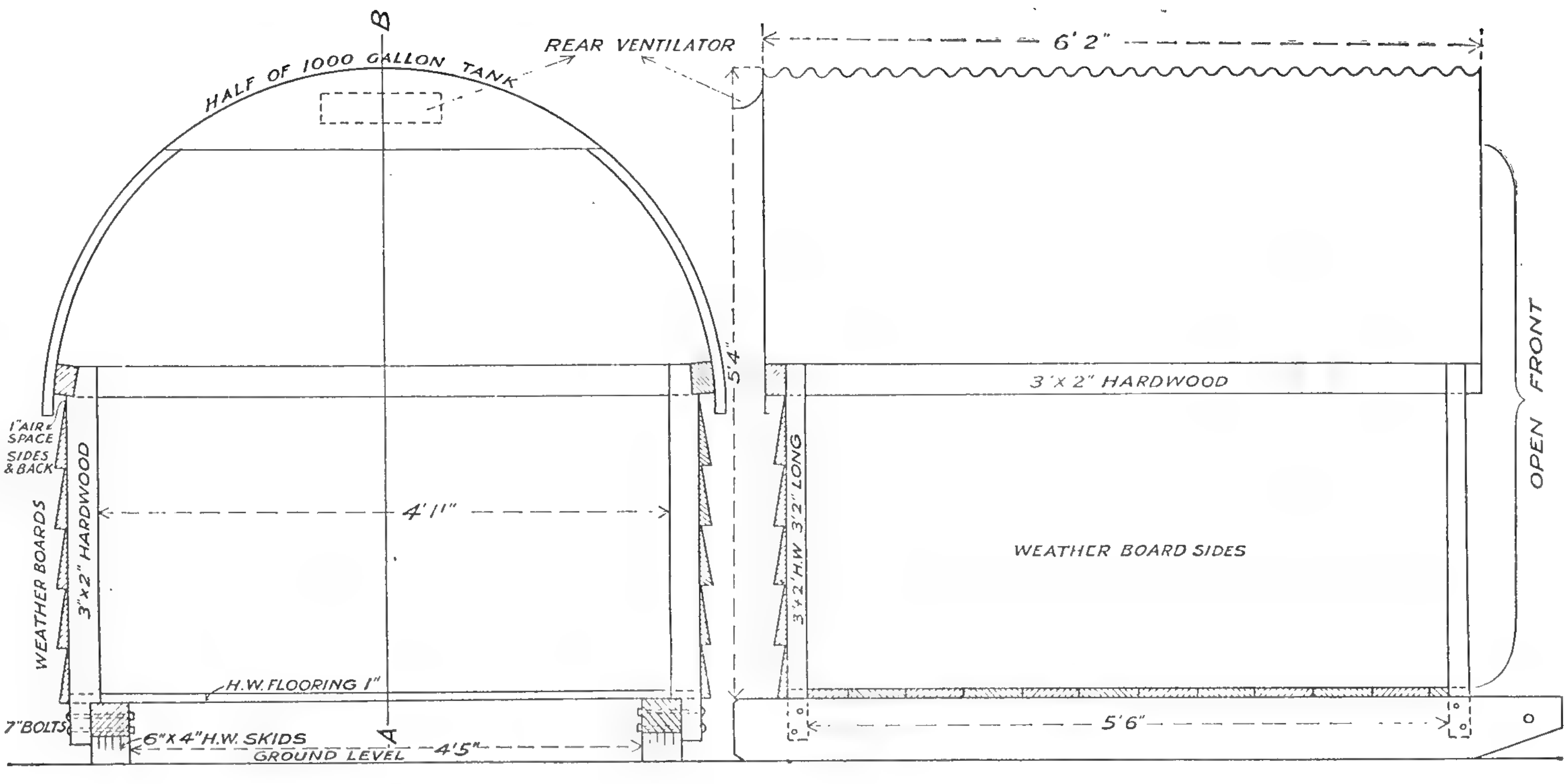


PLATE 82.

Plan of a portable shelter shed, using half a water tank. Note skids on which this shed is constructed, providing for ready means of moving the house when required.

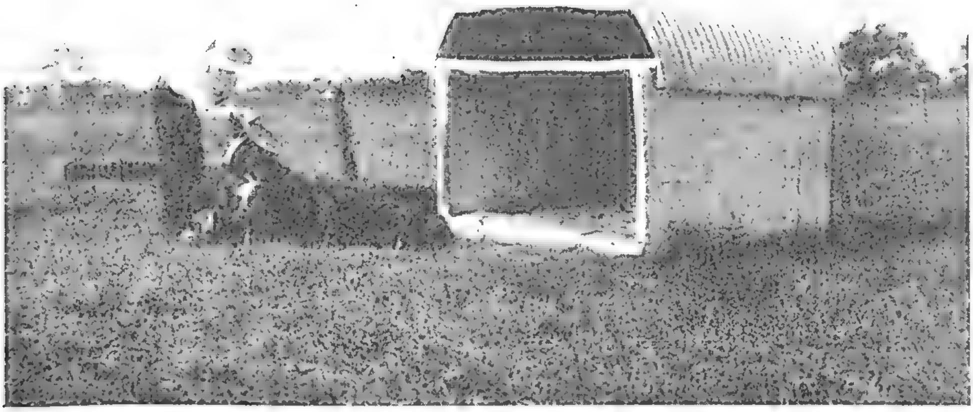


Plate 83.
A half-tank shed in use at the St. Lucia Training Farm.

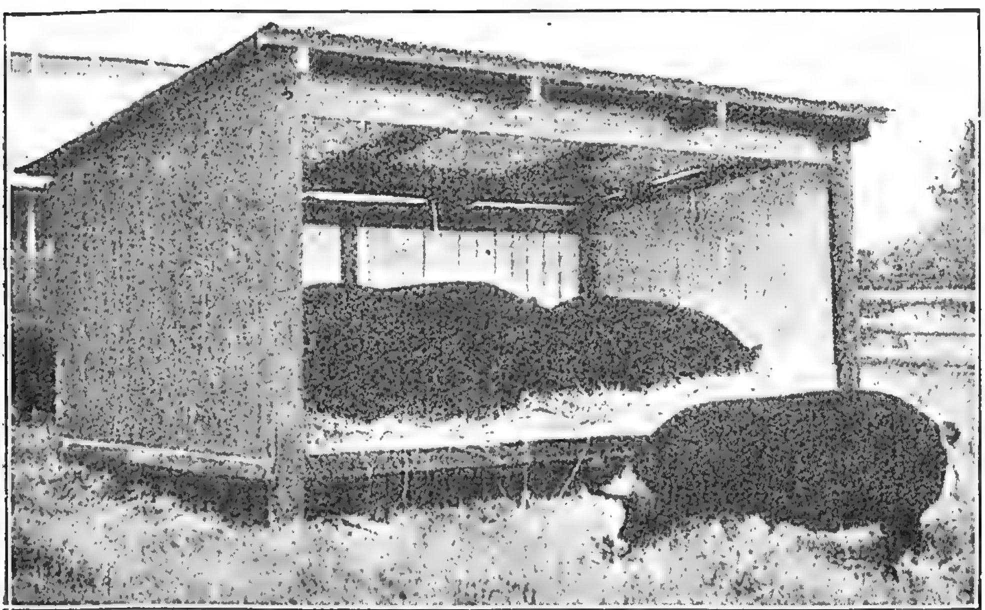


Plate 84.
An open-fronted shelter shed for use where the movable shed is not practicable.

Guard Rail.

All farrowing houses should be fitted with a guard rail to prevent young pigs from being crushed against the walls. Experience has proved that the use of this rail has saved an appreciable percentage of young pigs. This rail can be constructed of 3-inch by 2-inch hardwood, 1-inch water piping, or saplings. It should be placed 9 inches above the floor and 7 inches from the walls.

PLATE 85.
Woven wire pig fencing. Note the shade provided.

PLATE 86.
Straight saplings may be put to good use in pig fencing.

Fences.

The class of fence to be used on each farm will be governed mainly by the available material for its construction.

Pig fences need to be from 2 feet 6 inches to 4 feet in height, depending on the class of pigs to be enclosed. Large boars and sows sometimes have a tendency to jump fences, and for such animals a

PLATE 87.
Another durable pig fence.

4 feet fence would be necessary; however, a fence 3 feet high is usually sufficient to control pigs of all sizes, while young pigs are usually kept in their places by 2-feet 6-inch fences. To overcome this difference in the required heights of fences, posts should be 4 feet out of the ground so that the height of the fence may be raised to 4 feet, if necessary, by the use of extra barbed wires.

With pig pens, it is a fairly constant rule that the smaller the pen the more substantial the fences must be; the reverse also holds. It is usually advisable to have a line of barbed wire, either on the ground level or a few inches below, to prevent pigs from rooting under fences; logs or stones can sometimes be used for the same purpose.

Where wire fences are used it is advisable to either reinforce them or replace them by wood at the feeding end of the paddocks, as there is most wear and tear on this part of the fence.

Troughs.

The piggery should be equipped with troughs of sufficient capacity to feed the pigs without undue scrambling or fighting at feeding time. An average space of 10 inches should be allowed for each adult pig. The trough should have the capacity to hold a full feed for the pigs.

Pig troughs should be strongly constructed and have a smooth surface free from corners or cracks. Where portable troughs are made they should be of a size which allows of their being easily carried on to clean ground. With stationary troughs it is essential that they should be built on to a floor of concrete, brick, or timber to prevent the pigs from making an objectionable mud wallow beside the trough. Wooden slabs placed on the ground beside the feeding trough are very insanitary, even if they do keep the pigs out of the mud.

The most serviceable troughs are of concrete built into a concrete floor as shown in Plates 88 and 90.

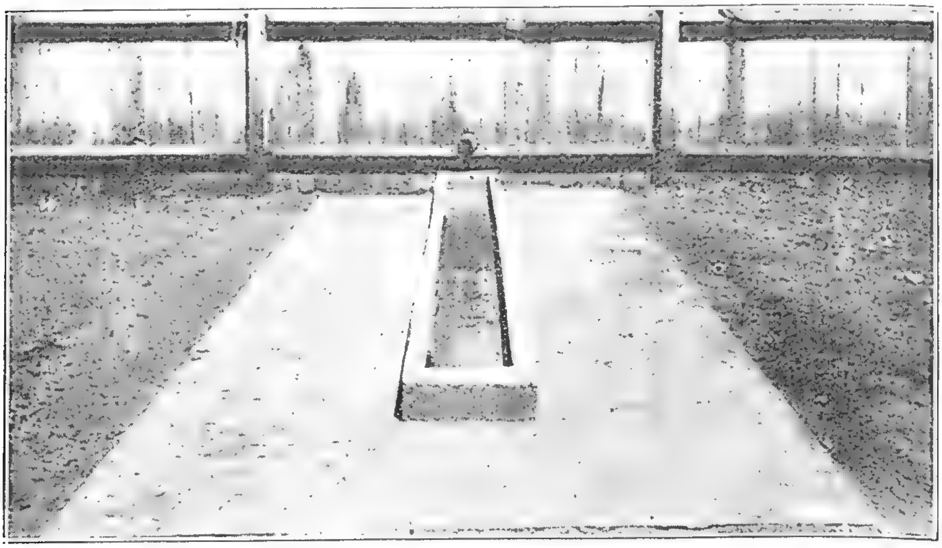


PLATE 88.
Concrete food trough and platform.

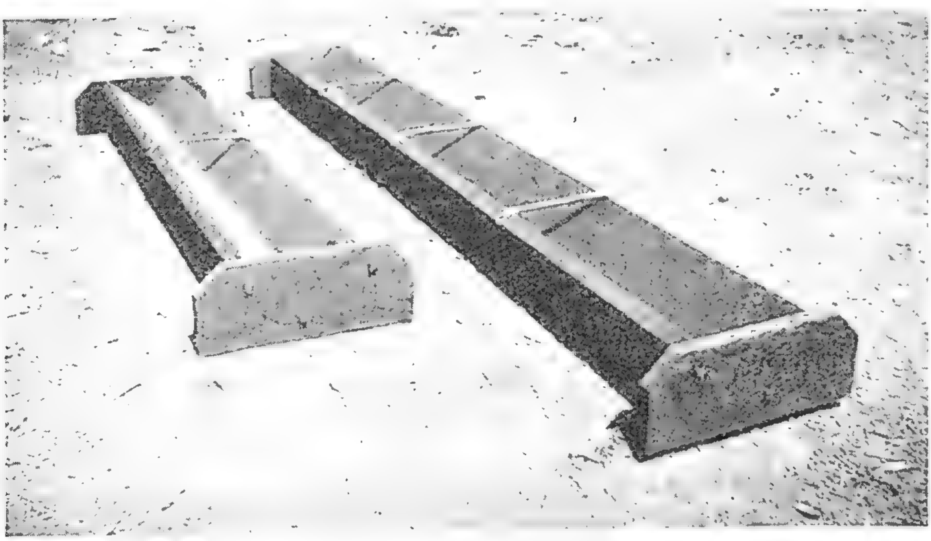


PLATE 89.
Handy V-shaped wooden troughs.

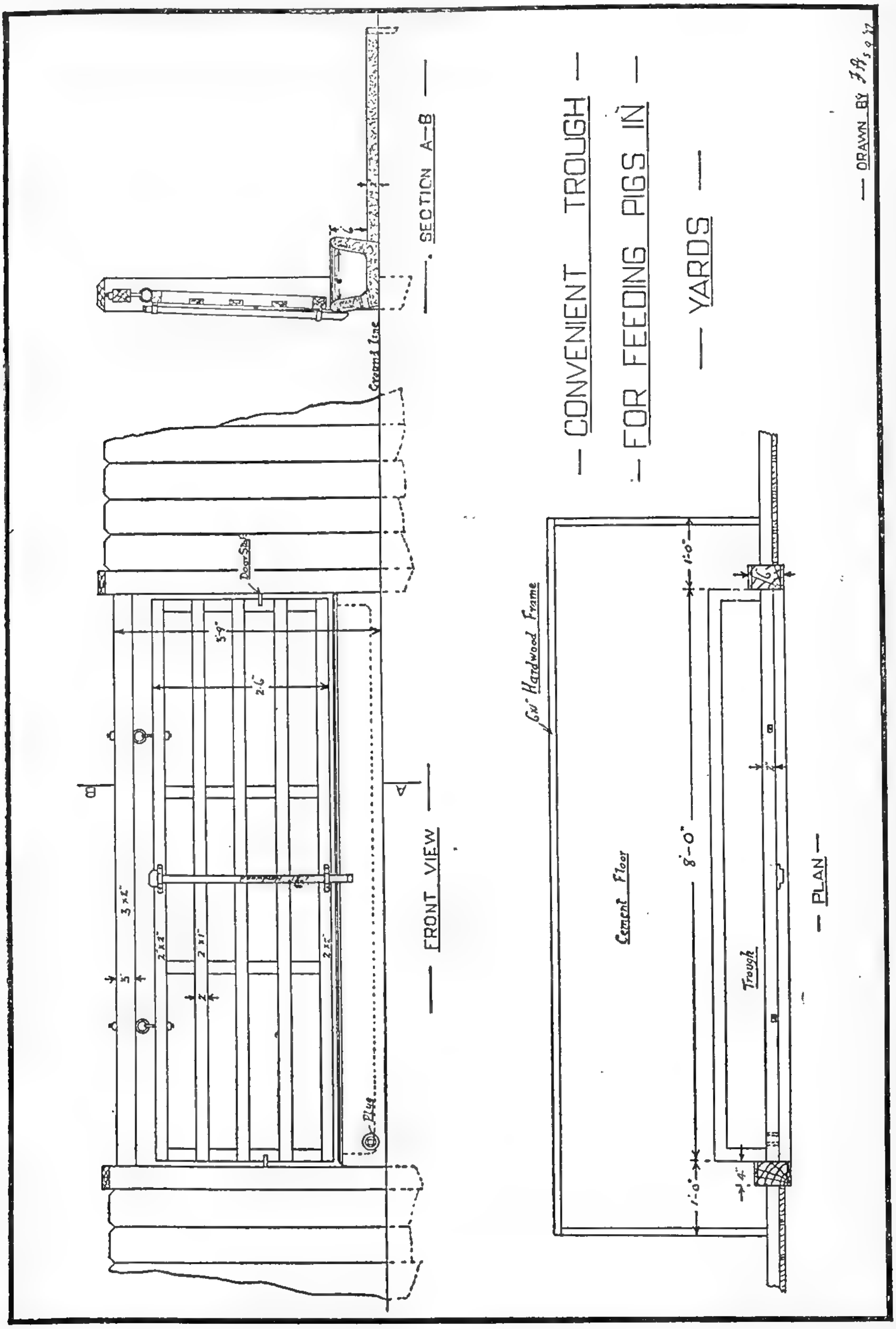


PLATE 90.

The trough illustrated in Plate 88 is 14 feet in length, and the width is 15 inches overall, having its sides of 2½-inch thickness, reinforced with barbed wire, lengthways. The trough is 5 inches deep and the inside width is 10 inches. The platform is 7 feet wide and 16 feet long

and 4 inches in thickness, and is surrounded by a protective flange 4 by 2 inch hardwood, bolted together at the corners to protect the edges of the platform from being broken away.

Improvements could be made to such a trough by having a bung in the end leading outside the pen to facilitate cleaning the trough. Also, if the end of the trough projected outside the fence, food could be poured in from the outside. Iron bars of ½-inch thickness set into the concrete across the trough 10 inches apart prevent the pigs from fighting at the trough, and also prevent pigs from rooting food out of the trough. In such a trough it is preferable to have all the corners rounded off in order to facilitate cleaning.

PLATE 91.
Automatic water fountain suitable for pigs in paddocks.

The V-shaped wooden trough, as illustrated in Plate 89, is very useful as a movable trough. This type of trough can be made of varying sizes to suit requirements. The timber must be sawn and tightly fitted to prevent leakages. A dressing of tar inside and out acts as a preservative of the wood, and also makes it watertight and more hygienic. Such a trough, built on a movable wooden platform, is most convenient for paddock use.

Cast and galvanised iron troughs of various designs are procurable from hardware stores, and these are satisfactory under certain conditions.

Automatic Waterer.

Plate 91 illustrates a watering device used at the Kairi State Farm piggery. A 40-gallon drum is set into a trough 6 inches deep and the whole is fixed on to a slide. The drum has a $\frac{1}{2}$-inch plug hole $1\frac{1}{2}$ inches from its bottom, and a larger plug hole for filling at its top. The lower hole allows the water to flow out to a sufficient height for the pigs to drink from the trough, and to fill the drum, the bottom hole is plugged and the top hole opened.

Self-feeders.

Self-feeding of pigs is as yet little practised in Australia, mainly because pigs are kept chiefly to utilise by-products, such as separated milk, which are not readily adaptable to self-feeding; but when the price ratio of grain and pork is such as to make the pig a profitable means of disposing of grain, pig raising must be considered from a somewhat different viewpoint.

Plate 92.

Baconers grown on the self-feeder in which was placed a mixture containing 80 lb. maize meal, 10 lb. lucerne chaff, and 10 lb. meatmeal. The pigs were also given unlimited supplies of water to drink.

The grain grower who keeps pigs, but has no milk foods, can make good use of his grain by feeding it in combination with such feeds as lucerne chaff and meatmeal, both of which are substitutes for separated milk in the pig's ration. Such feeds as these are adaptable to dry feeding through a self-feeder whereby the pigs have several days' food supply placed in the feeder and they are allowed to help themselves.

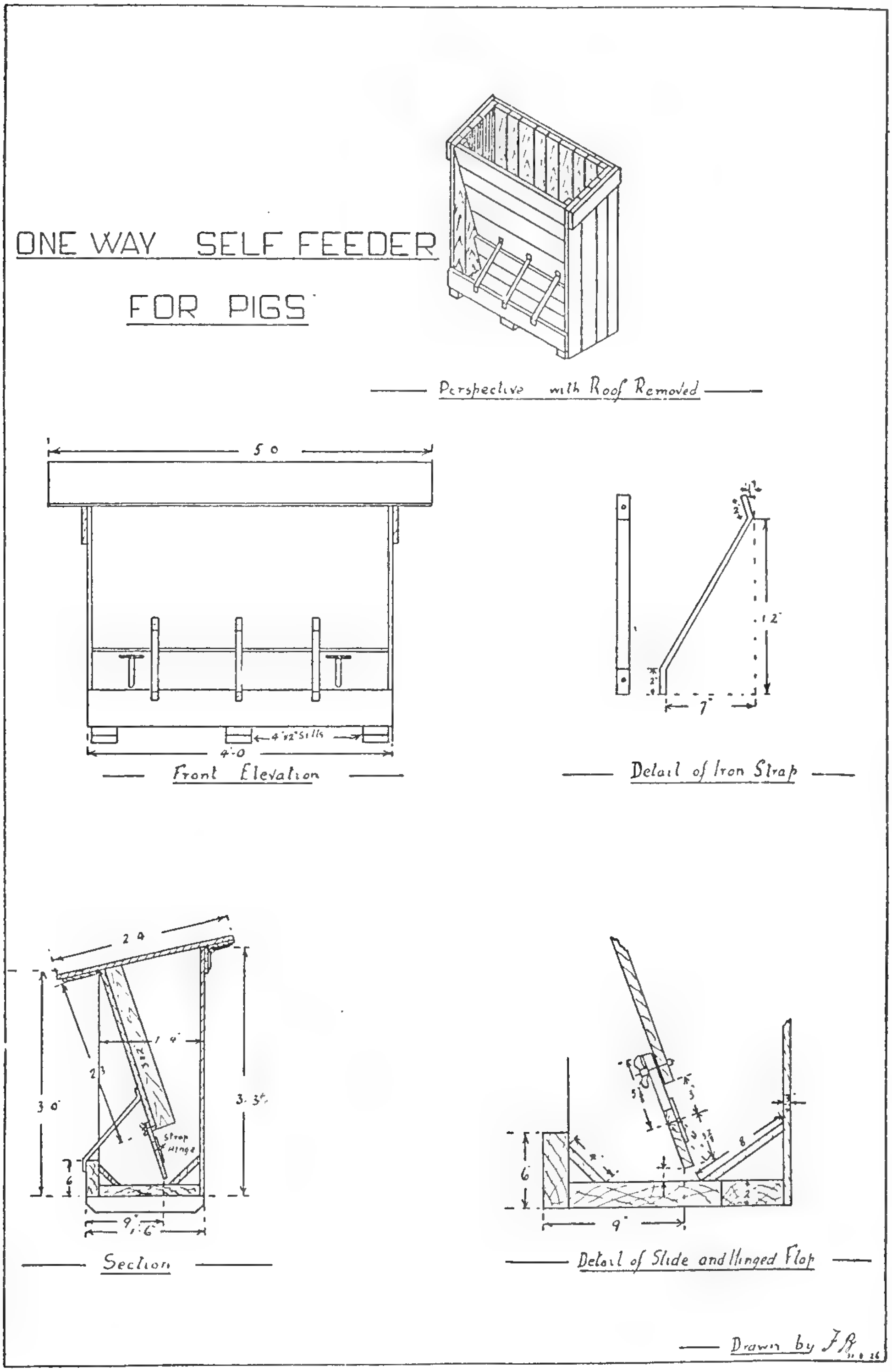

ONE WAY SELF FEEDER
FOR PIGS
Perspective with Roof Removed
5 0
4'-0
Front Elevation
12"
7"
Detail of Iron Strap
2 4
1 4
3 0
Strap Hinge
Section
6
9"
8
Detail of Slide and Hinged Flap
Drawn by

PLATE 93.

Under certain conditions self-feeding has many advantages and is worthy of further trial.

Plates 92 and 93 illustrate a type of self-feeder which has given satisfactory results in practice.

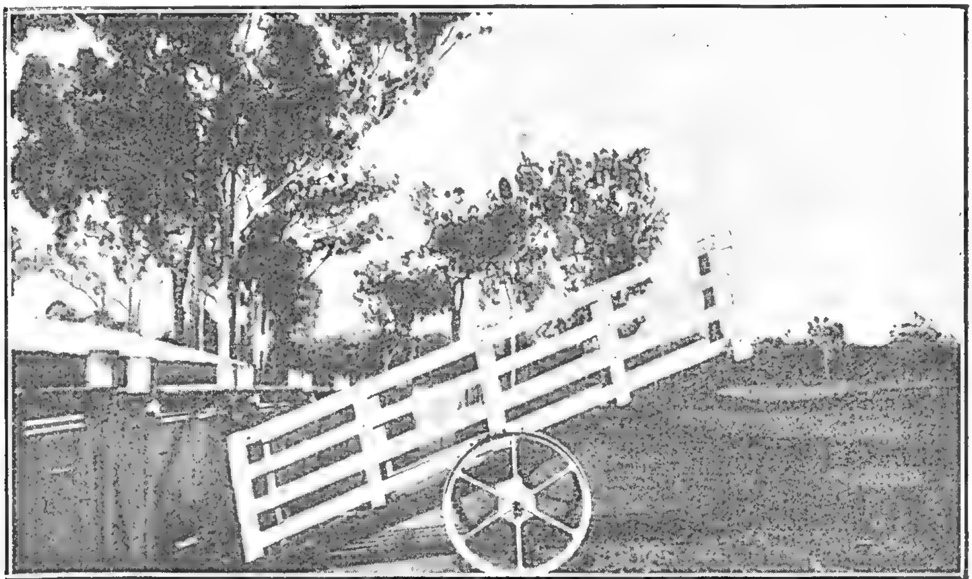


PLATE 94.
A useful portable loading race.

ONE-WAY SELF-FEEDERS FOR PIGS—MATERIAL REQUIRED.

Members.	Number.	Length. Ft. In.	Size.	Material.
Skids	Three	1 6	4 in. x 2 in.	Hardwood
Trough	One	4 0	6 in. x 2 in.	Pine
Trough	One	3 10½	12 in. x 2 in.	Pine
Trough	One	3 10½	4 in. x 2 in.	Pine
Trough	One	3 10½	8 in. x ¾ in.	Pine
Trough	One	3 10½	4 in. x ¾ in.	Pine
Front panels	Five	3 10½	6 in. x ¾ in. T. & G.	Pine
Front panels	Two	2 3	3 in. x 2 in.	Pine
Sliding and hinged flaps	Two	3 10½	4 in. x ¾ in.	Pine
Ends and back	Twenty-four	3 3	6 in. x ¾ in. T. & G.	Pine
Ends and back	One	7 0	6 in. x ¾ in.	Pine
Top	Ten	2 4	6 in. x ¾ in. T. & G.	Pine
Top	Two	5 0	6 in. x ¾ in.	Pine

Hardware—Three 1-inch by ¼-inch iron straps.
Six 3-inch strap hinges.
Two 3-inch by ½-inch bolts with thumb nuts
Nails, &c.

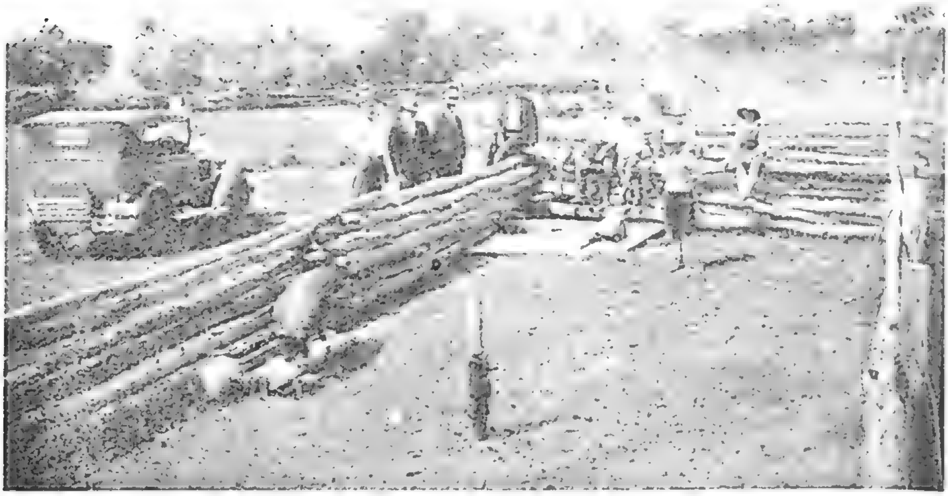


PLATE 95.
This junior farmer club member provides his pig with an oiling post.

PLATE 96.
A wooden crate suitable for weighing pigs. Note the strong construction, "slide-up" doors at both ends, and wires coming from bottom of crate to be attached to hook of the spring balance. Softwood should be used in the construction of the crate so that its weight will not be too great.

Shade.

(*See* Plate 85.)

Pigs should be provided with ample cool shade in hot summer months, and this can be done either by planting shrubs or hedges, or by building a framework of 3-inch by 2-inch hardwood and covering the top with bushes or thatching it with grass. Where a clump of natural scrub can be left in the pig paddock, good shade is provided where the pigs can burrow away into the cool and find comfort during the hottest part of the day.

Plate 97.

Crate in position, ready for use with front door closed. Note the arrangement of the top beam, lever, and spring balance.

Oiling Post.

An occasional application of oil to the pig's skin keeps it in soft and healthy condition, and at the same time the oil destroys lice and other external parasites on the pig. A convenient self-oiler can be made by wrapping a bag or a rope round a post or a tree in the run from the ground level up to a height of 2 feet. The bagging or rope is kept saturated with oil, and the pigs oil themselves by rubbing against the post. Crude petroleum oil or used sump oil is useful for oiling pigs.

Weighing Pigs.

As both pork and bacon pigs are usually sold on a basis of weight and quality, and as the ruling price per lb. varies according to specified weight limits, it is important to the pig raiser that he should have a fairly accurate knowledge of the weight of his animals before they are offered for sale.

On account of pig trucking days being two or more weeks apart in some districts, farmers are sometimes forced to market their pigs either too early or too late to have them at the most profitable marketing weights, but in many cases a farmer is able to market his pigs to much better advantage when he is able to weigh them on the farm at regular and frequent intervals prior to trucking.

Even after years of practice, guessing the weight of pigs is not so reliable as weighing them, and where regular consignments of pigs are sent from a farm the use of weighing scales can be recommended, for, with intelligent use, they soon more than defray their cost in the saving of cash effected by marketing pigs at the most profitable weights.

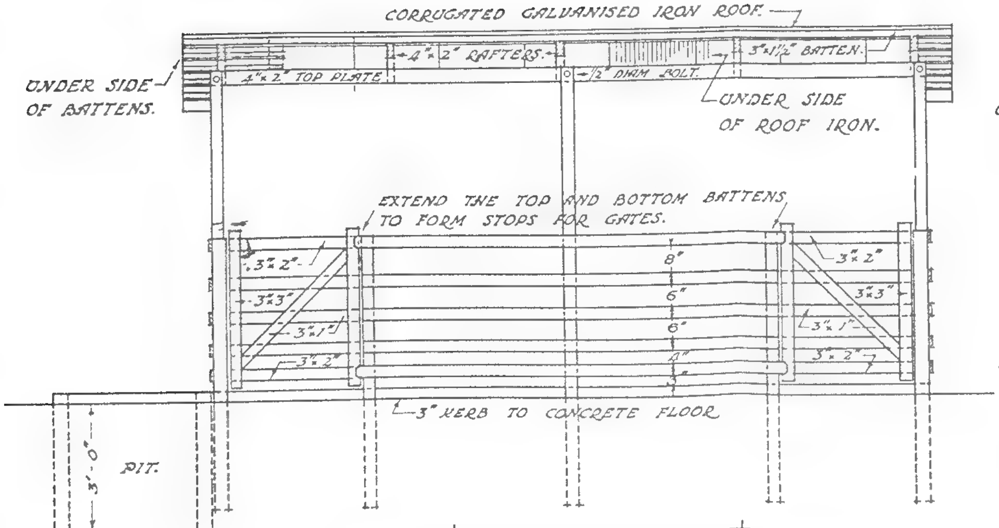
The crate should be light, yet strong; a convenient size for a crate to hold one bacon pig is 3 feet 6 inches long, 2 feet 6 inches high, and 1 foot 6 inches wide (inside measurements).

If the weighing crate is arranged in a race, the pigs can be brought from their yard, weighed, and then returned to the yard conveniently.

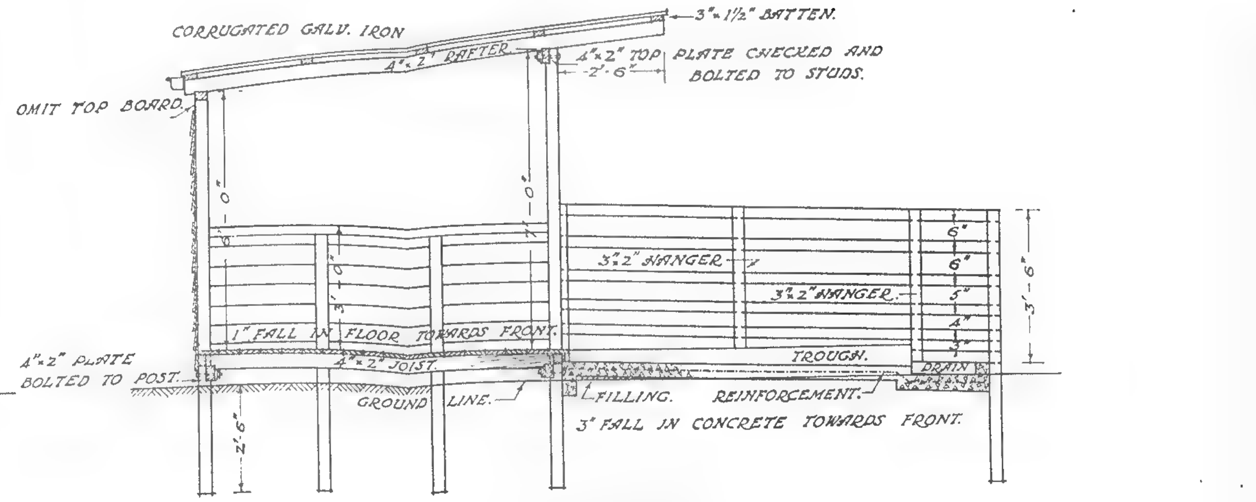
There are many good methods of weighing pigs on the farm, and the most suitable method must be determined according to circumstances, but the suggestions given herein will be helpful to a large number of pig raisers. Special platform scales with a pig crate built on can be purchased at prices around £50, but at such a price their use must be limited to very large piggeries and trucking yards where large numbers of pigs are weighed.

DEPARTMENT OF AGRICULTURE AND STOCK. QUEENSLAND.

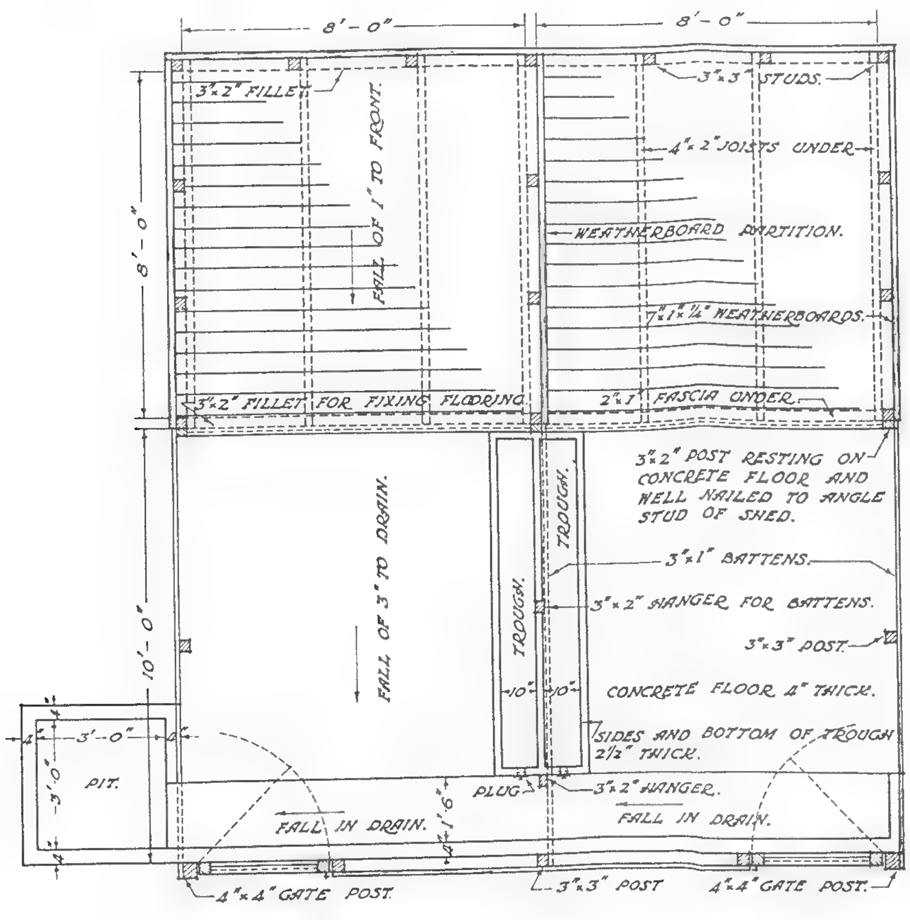
PIG PENS FOR INTENSIVE HOUSING.



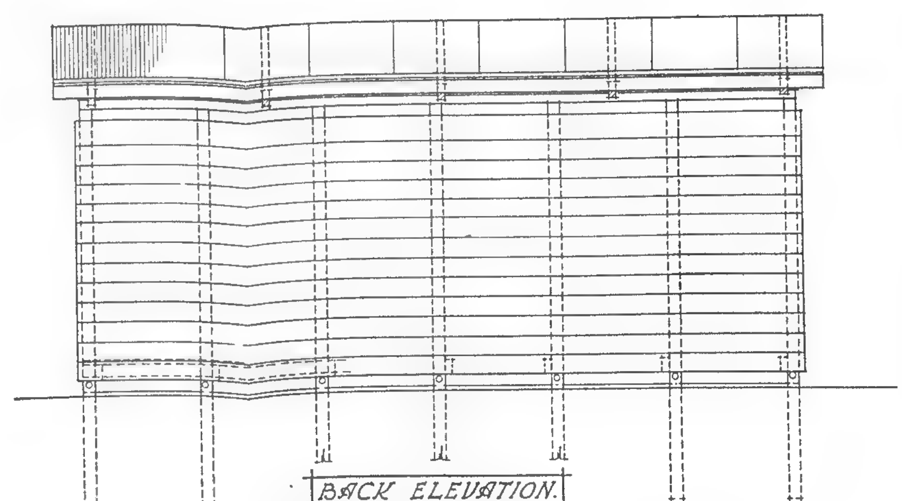
FRONT ELEVATION.

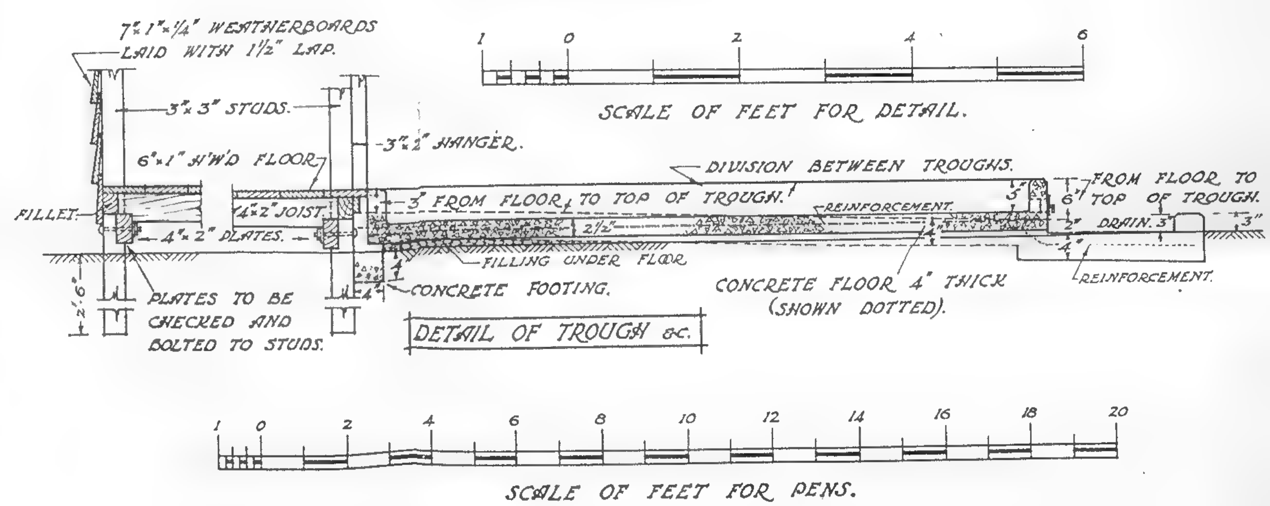


CROSS SECTION.



PLAN.


BACK ELEVATION.



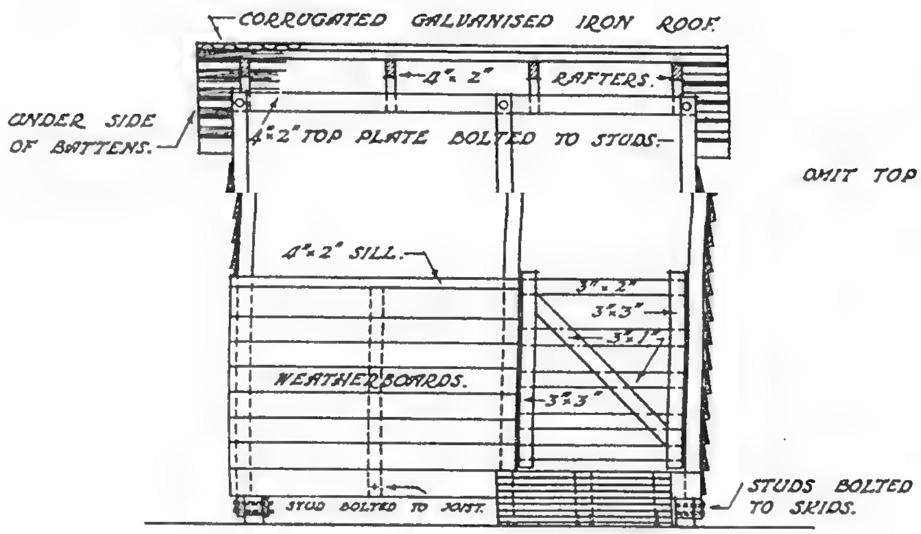
DETAIL OF TROUGH &c.

SCALE OF FEET FOR DETAIL.

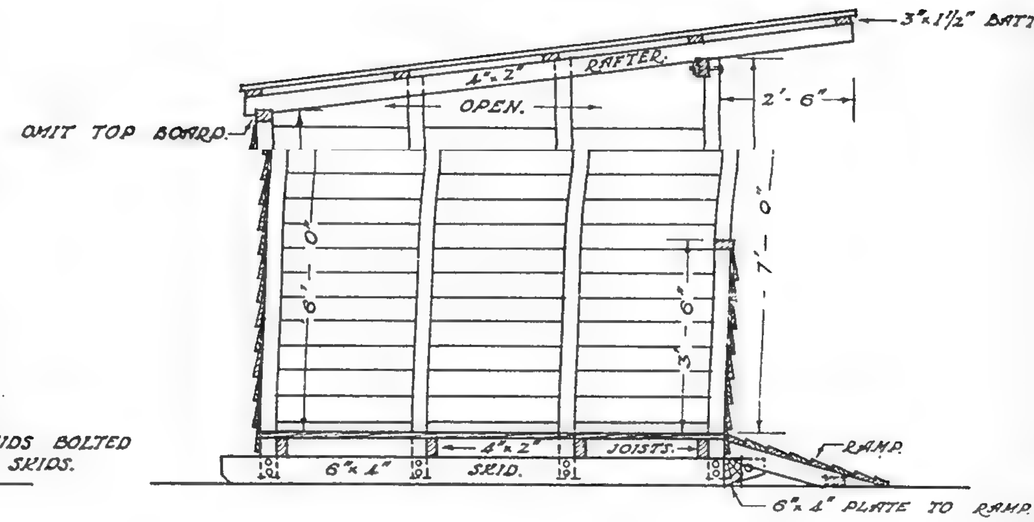
SCALE OF FEET FOR PENS.

DEPARTMENT OF AGRICULTURE AND STOCK.
QUEENSLAND.

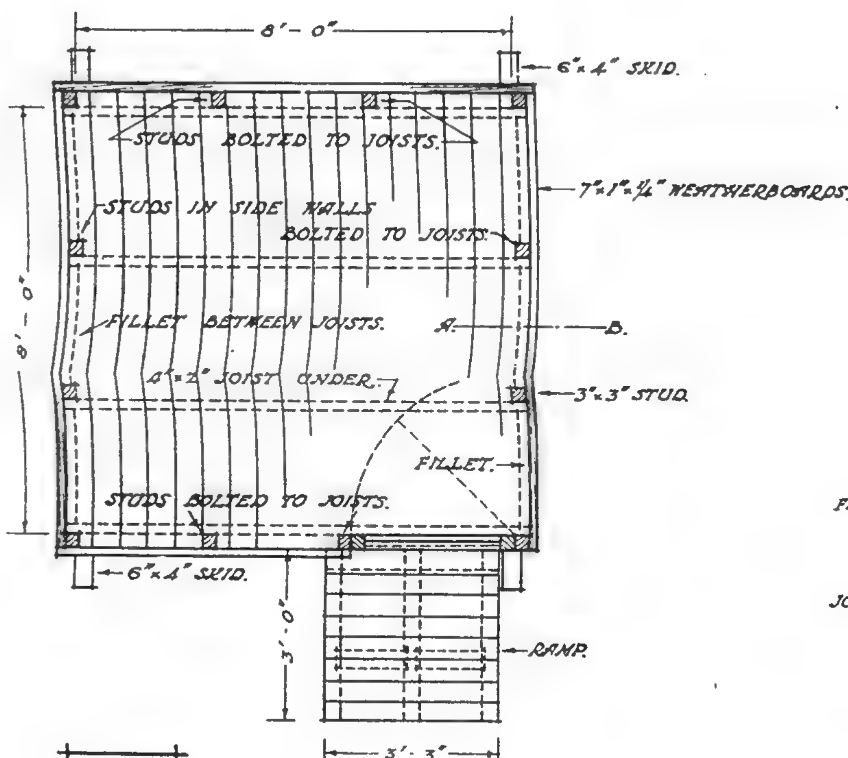
PORTABLE PIG SHED.



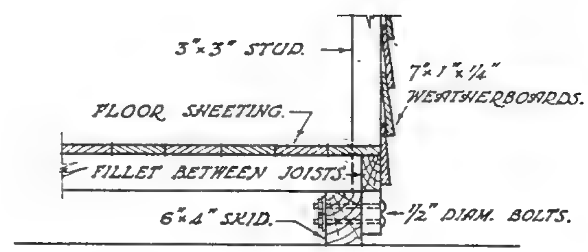
FRONT ELEVATION.



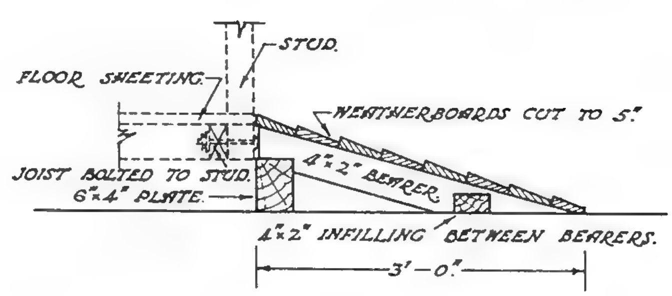
SECTION THROUGH SHED.



PLAN.



DETAIL SECTION A-B.



DETAIL OF RAMP.

SCALE OF FEET FOR DETAILS.

SCALE OF FEET FOR PENS.

The Feeding of Poultry.

By P. RUMBALL and J. J. McLACHLAN, Poultry Staff,
Department of Agriculture.

THERE is probably no matter of greater importance to the successful poultry raiser than that of feeding. For this reason and to assist in the economical utilisation of the various foods available, poultry raisers should have a thorough knowledge of the principles underlying feeding. Although it is possible for many to buy mixed foods suitable for either egg production or the growth of young stock, it is not always advisable for the commercial poultry raiser to rely solely on these foods, for the distance from the manufacturer adds considerably to their cost; besides it may also be possible for the poultry keeper to make use of foods obtainable in different localities at lower values.

Poultry, as with all livestock, require food first for the maintenance of the bodily functions—that is, the supplying of heat and energy and repair of waste tissue, the surplus only being used for body development, or, in the case of moulting stock, the growth of feather, and in laying stock the production of eggs. It is possible, and it frequently happens, to retard the development of growing stock by incorrect feeding, and in adult stock to just maintain the birds in perfect health without procuring the desired production of eggs. It is, therefore, essential for the poultry raiser to realise at the outset that under-feeding is not conducive to satisfactory results, also that the production of eggs or the bodily growth of young stock can only be obtained by feeding quantities in excess of the bodily requirements of the bird.

To attain success in poultry feeding, a practical knowledge of food values, the classification of ingredients, uses of these ingredients, and the composition of various poultry foods is necessary.

Classification of Food Ingredients.

The food ingredients are generally classified in the following groups: —Proteins, carbohydrates, fats and oils, fibre, ash, and moisture.

In addition to this classification, most careful consideration has to be given to substances known as vitamins, for it has been proved by experiment that it is impossible to obtain correct development in growing stock, or satisfactory egg production from laying hens, with a properly balanced ration of protein and carbohydrates if certain vitamins are absent. Further, the absence of essential vitamins is responsible for diseases of a malnutritional nature and the reduction of natural resistance against diseases.

Protein.

Protein is a compound built up of nitrogen, hydrogen, oxygen, and a few minor constituents. During the process of digestion the insoluble proteins are converted into soluble amino-acids which are absorbed by the walls of the intestines, passing into the circulating blood, by which means they are transported to the various parts of the body to fulfil their functions. There are about twenty known amino-acids, many of which are essential to the well-being of the fowl. All forms of these acids are not found in any one class of food, consequently it is necessary to have variety in the ration in order to avoid the absence of any essential amino-acid.

As there is approximately 20 per cent. of protein in the body of the fowl (live weight), the importance of feeding an ample supply of protein can be understood, but it is not wise, in fact harmful, to feed protein-rich foods to excess. In the first place, protein-rich foods are generally the most expensive of the food material available, and for this reason an excess is uneconomic. Secondly, protein cannot be stored in the body for future requirements. The surplus after being converted into amino-acids is divested of its nitrogen by the liver and converted into fat, and is stored as such, and the separated nitrogen voided as uric acid through the kidneys. Therefore, as well as an excess being uneconomic, it places an undue strain upon two vital organs—namely, the liver and kidneys.

Carbohydrates.

Carbohydrates are compounds of carbon, hydrogen, and oxygen. Substances such as sugars and starches are carbohydrates. During digestion these substances are broken down into simple sugars and absorbed. After absorption these sugars combine with the oxygen of the blood and are converted into carbon dioxide and water. The process of oxidisation yields the heat and energy required for the functions of the body. Excess of carbohydrates are stored as fats within the bird.

Fats.

Fats are compounds of carbon, hydrogen, and oxygen. The oxygen content is about 11 per cent., whereas that of carbohydrates varies from 49 to 53 per cent. Fats and oils are used by the bird to supply heat and energy, the surplus being stored as fat. Owing to the greater quantity of oxygen necessary to oxidise fats and oils, due to its lower oxygen content, a given quantity of such substance will create more energy than a similar quantity of carbohydrates.

Fats to be absorbed by the system must first be converted into fatty acids and glycerine. They are not so easily digested as carbohydrates, and should not be fed to excess. As a heat and energy producer fats are worth from 1·9 to 2·5 times as much as carbohydrates.

Mineral Matter.

Mineral matter is that portion of plant or animal life that is left after burning. It is used in building up the frame, and in the fluids of the body to control digestion and absorption. It has been established by practice that all the minerals required by poultry are not present in the usual food supplied on commercial farms, also that the mineral requirement of the fowl varies with age. Only a sufficient quantity of mineral matter is absorbed by the fowl for immediate requirements, consequently a continuous supply must be fed.

Fibre.

Fibre includes the least digestible of foods, such as the outer cells of grains and fibrous matter in plants. Excessive quantity of fibre are to be avoided, as they are not only indigestible by poultry but, when excessively fed, especially in young stock, irritate the intestines.

Vitamins.

Vitamins are now known to be chemical substances, and may be classed as accessory food supplies. No matter how well a ration may

be balanced, without these substances satisfactory results cannot be obtained. There are five vitamins, commonly known as A, B, C, D, and E.

Vitamin A may be referred to as a growth-promoting factor. It is built up by plants, and is found in green feeds, lucerne chaff and meal (commonly used as a green-feed substitute), bran, yellow maize, and whole wheat, and is rich in cod liver oil. The absence of this vitamin in a ration fed to adult stock will cause nutritional roup and render the birds more susceptible to coccidiosis, fowl pox, severe colds, tapeworm infection, &c. Its presence in sufficient quantity will increase production, hatchability, and better development in growing stock.

It has been estimated by one authority that it is necessary to feed with bran and pollard 5 per cent. dry lucerne and 30 per cent. yellow maize meal with grain feeding in the evening of equal parts yellow maize and wheat to supply all the vitamin A necessary to good production.

The most economic form of supply of this vitamin is green feed and yellow maize, while the most convenient, in the absence of either of these foods, is 1 per cent. of a good grade of cod liver oil.

Vitamin B.—This vitamin is common to most of the foods fed to poultry, and no trouble has been recorded due to its shortage.

Vitamin C.—It was at one time thought that poultry were not susceptible to scurvy, but a recent report of an American authority indicated that growing chickens were subject to the disorder, but only after feeding a ration that would not be used commercially. This vitamin does not appear to be of importance in poultry feeding.

Vitamin D.—This vitamin, with vitamin A, is most important in the feeding of poultry. It is essential for the assimilation of the calcium and phosphorus, and naturally most important to the growing birds. This vitamin is present in abundance in cod liver oil, but its cheapest form is sunlight. Sunlight enables it to be developed in the body of the bird. With modern conditions of rearing it happens that chickens, and at times adult birds, do not get all the sunlight they should. In such cases cod liver oil can be used as a substitute. Prolonged overfeeding of vitamin D produces loss of appetite, followed by loss of weight, general ill-health, and ultimately death.

Vitamin E.—This vitamin is associated with reproduction. Investigations have shown that the feeding of rats with a ration in which this vitamin was absent brought on sterility. Sterility was cured by the feeding of small quantities of wheat germ oil. In practice breeders would guard against the possible cause of infertility by feeding good sound wheat or wheat germ oil and green food in the ration of their breeding stock.

Digestibility of Foods.

The chemical composition of a food does not indicate its digestibility, and as regards poultry little is known on the subject. It is a question that can only be definitely ascertained by feeding experiments conducted with poultry.

Palatability of Food.

Results are not obtained by making up a ration with definite proportions of the constituents referred to later unless the fowls will eat

it. If they become hungry enough they will consume a sufficient quantity of almost any food, but it will be at the cost of a very much reduced egg yield. Upon analysis, barley is found to be a food carrying almost the right quantities of protein and carbohydrate essential for egg production, but when put into practice we find that fowls do not relish the grain, and they have to be gradually accustomed to consume it. It may be as well here to mention that in making any change in the ration to laying stock, do so gradually, as sudden changes in the diet cause a reduced egg yield and frequently a false moult.

Methods of Feeding.

Several methods of feeding are commonly practised, and in many instances with equal degree of success. Each method has its own advantage and appeals to the individual feeder.

The methods are known as—(1) wet mash and grain, (2) dry mash and grain, (3) all-mash, and (4) pellets.

Wet Mash and Grain.

The mash is a mixture of different ingredients, moistened to the extent that when a handful is squeezed it will remain in mass form, and when dropped a few inches will break up into small particles. It would be more in keeping with this class of mash if it were termed "moist" instead of "wet."

With this type of feeding the mash has to be prepared daily and distributed to the birds, care being taken to feed sufficient for their requirements and not allowing any to remain unconsumed—say, after an interval of half-an-hour after feeding. The mash should be placed in shallow narrow tins or troughs, and as the food should be consumed within about half-an-hour there should be no lack of feeding space or the more timid class of bird will not procure all that she requires for maximum production.

It is usual to feed wet mash first thing in the morning and grain at night. Many breeders reverse this order with successful results, and find that it fits in better with the daily routine.

Dry Mash and Grain.

A mash similar to that used for a wet mash is prepared and placed in hoppers. Birds are at liberty to consume the food at will, and although certain feeding space has been found necessary for best results the more timid fowl has a better chance of securing its requirements from a limited space than is the case in wet mash feeding. One foot of hopper space should, however, be allowed for each ten birds. The advantage of the system of feeding is that instead of mixing and feeding mash daily a quantity can be prepared and distributed once per week, and so reduce the labour of feeding. The most serious disadvantage, however, that the writer sees in this method is that the constant supply of feed encourages rats to harbour in the poultry pens.

With this system of feeding grain is usually fed during the evening, allowing birds ample time to scratch and find grain distributed.

All Mash.

As the name suggests, nothing but mash is fed. A suitable mixture is made and placed in hoppers. The birds have access to this food at

all times throughout the day. This system of feeding possesses advantages over both the other systems previously mentioned, although it has the disadvantage of encouraging rats. With the all-mash system, quantites of food can be placed out once per week, thereby saving the daily attention of feeding. The birds are also compelled to consume a ration suitably balanced, and from practical experience this system suggests the possibility of preventing breeds of the heavy variety putting on excessive internal fat. Production with this system of feeding is equal to any other. Fowls do not take kindly to radical changes in grain feeding, but with the all-mash system the meal of various grains may be substituted without any appreciable easing in production. Naturally, the converting of grain into meals increases the cost of feeding slightly, but the saving in labour and the assurance that the birds are being fed a ration suited to their requirements appear to justify the slight increase in cost.

Pellet Feeding.

Pellet feeding is nothing more or less than the feeding of an all-mash in the form of pellets. The feeding of the food in this manner enables the bird to obtain a sufficient quantity of food in much less time than when the food is in the form of a mash, but when sufficient hopper space is allowed and the birds have been reared upon all-mash they appear to have no difficulty in consuming all they require. The feeding of pellets is more costly than any other system, due to the fact that they have to be manufactured.

The Feeding of Chickens.

In the feeding of chickens it is most important to bear in mind that nature has provided for the first day or so of the chicken's life, as just prior to hatching the balance of the egg yolk is drawn into the abdomen of the chick. Most breeders allow at least forty-eight hours to elapse before feeding. Chickens fed earlier are subject to bowel trouble. A system of prolonged starving, however, should not be practised, as it has a weakening effect, from which many chickens do not recover.

Requirements for Growth.

Chickens make very rapid growth the early part of their life. This development is most rapid during the first six to eight weeks, consequently rations having a relatively high protein content are necessary to give the best development. From experimentation it has been fairly definitely established that rations having a crude protein content of 20 per cent. should be used during the first six to eight weeks, and after that period reduced to 15 per cent. The protein requirement of a chicken does not alter as sharply as is suggested, but these periods and protein content are suggested as meeting the practical requirements of the poultry raiser.

It is a common practice among many poultrymen to cut down the protein content after the chickens are about sixteen weeks of age, in order to delay sexual development. This, we think, is desirable if the birds are maturing too rapidly, but development can be controlled to only a very limited degree. Excessive protein feeding must be guarded against, as constant and overfeeding of protein-rich foods causes deposits of urates in the ureter, kidneys, and other organs, as well as placing an undue strain upon the liver.

It is generally conceded that milk is the most desirable protein feed for chickens and growing stock, but owing to its cost its exclusive use is not possible. Wherever possible milk should form a portion of the ration. It may be given in the form of curds, semi-solid milk, butter milk, or butter milk powder. As a drink milk is excellent, but it is objectionable owing to the difficulty of keeping chickens clean. The writer favours butter milk powder, owing to the ease with which the powder may be incorporated in the mash, thereby controlling the kind of food that each chicken consumes. It has, however, no definite advantage from a feeding value point of view apart from its concentration. Proteins build up the flesh, but at the same time a bony framework is necessary. Analysis of the chicken at different ages, according to Halman, indicates that it was particularly important to allow for the mineral requirement from the eleventh to the twenty-fourth week. In all experiments conducted by the Department, the increased mineral intake has been allowed for by the addition of bonemeal to the mash at eight weeks of age, and by allowing the birds free access to grit (shell and hard).

Food Consumption of Chickens.

One is often asked how much food should be given to chickens. Probably no better reply can be given than the publishing of a table from actual experiments conducted in this State.

FOOD CONSUMPTION AND WEIGHT OF CHICKENS.

Age.	Leghorns.		Australorp.	
	Weight of Chickens.	Food Consumed.	Weight of Chickens.	Food Consumed.
	ozs.	ozs.	ozs.	ozs.
Day old	1·3	..	1·36	..
1 week	1·97	1·64	2·14	1·53
2 weeks	3·31	3·36	3·61	3·32
3 weeks	5·31	4·80	5·84	5·05
4 weeks	7·61	6·46	8·68	7·20
5 weeks	9·94	7·58	12·08	6·89
6 weeks	12·92	8·96	15·86	10·62
7 weeks	16·65	8·65	20·17	13·95
8 weeks	20·41	13·29	25·31	15·05

The variation in weight from week to week and the ever-increasing amount of food required suggests the undesirability of indicating what should be supplied.

The food requirements increase week by week, and a system of feeding where the growing birds may consume all they require is the most desirable.

The all-mash method of feeding chickens by reason of the fact that the kind of food consumed is easily controlled, and that it is always in front of the birds, is suggested as being the most desirable. All-mash should be placed in shallow trays about 1 inch in depth during the first few days. The trays are then increased to a depth of 2 inches, and by the end of the first week troughs about 4 inches wide may be used. At this age chickens will commence to scratch, scattering the feed from the trough. This can be prevented by placing a piece of

netting on top of the mash loose enough to sink as consumption takes place. During the first week 8 feet of feeding space should be allowed for every 100 chickens, and later increased to 12 feet. Prior to the mash being covered with netting it is important that only a little food at frequent intervals should be placed in the trays in order to avoid wastage.

In fact, the frequent feeding of all-mash appears to induce a greater food consumption, with the result of better development.

Breeders who do not desire to feed an all-mash could make use of commercial chick grains and growing mashes. These could be fed as directed by the manufacturers. It has been the general custom for many poultry raisers to use scratch grain only for a short period of a chicken's life, but in the view of the more satisfactory results obtained by feeding a ration of a relatively higher protein content than chick mixtures usually have, early mash feeding appears essential.

Chickens may be reared satisfactorily upon moistened mashes and grain from about two weeks of age, but the mashes must be fed at frequent intervals. This system offers the advantage of utilising milk as a medium of moistening the mash when such is available. The feeding of dry mash, however, is suggested as a safer method of feeding, as the possibility of food becoming sour, with the probable consequence of bowel trouble among chickens, is avoided.

Suitable All-mash Mixture.

The following mashes have been used successfully in experiments conducted by the Department, and are suggested as a basis upon which to work. At times it may not be commercially sound to stick hard and fast to the ingredients suggested, but from the table of analysis supplied it will be possible for the breeder to compound other suitable mixtures.

Ration.	1–8 Weeks.	8 Weeks to Maturity.
Maize meal	40	56
Bran	20	10
Pollard	20	10
Meat and Bone meal	7½	5
Dried buttermilk	10½	5
Salt	1	1
Cod Liver Oil	1	1
Peanut meal	..	10
Bone meal	..	2
Crude protein content	17·15	18·07

The ration in this test from eight weeks to maturity carried a greater protein content than subsequent tests have proved essential, likewise better results have been obtained with rations of higher protein content during the first period. The suggestion is made that 20 per cent. should be the standard for the first eight weeks, and then reduced to 15 per cent.

Requirements for Egg Production.

The laying fowl has first to provide from her food supply for—

(1) Maintenance of vital functions;

(2) Growth requirements; and

(3) The production of eggs.

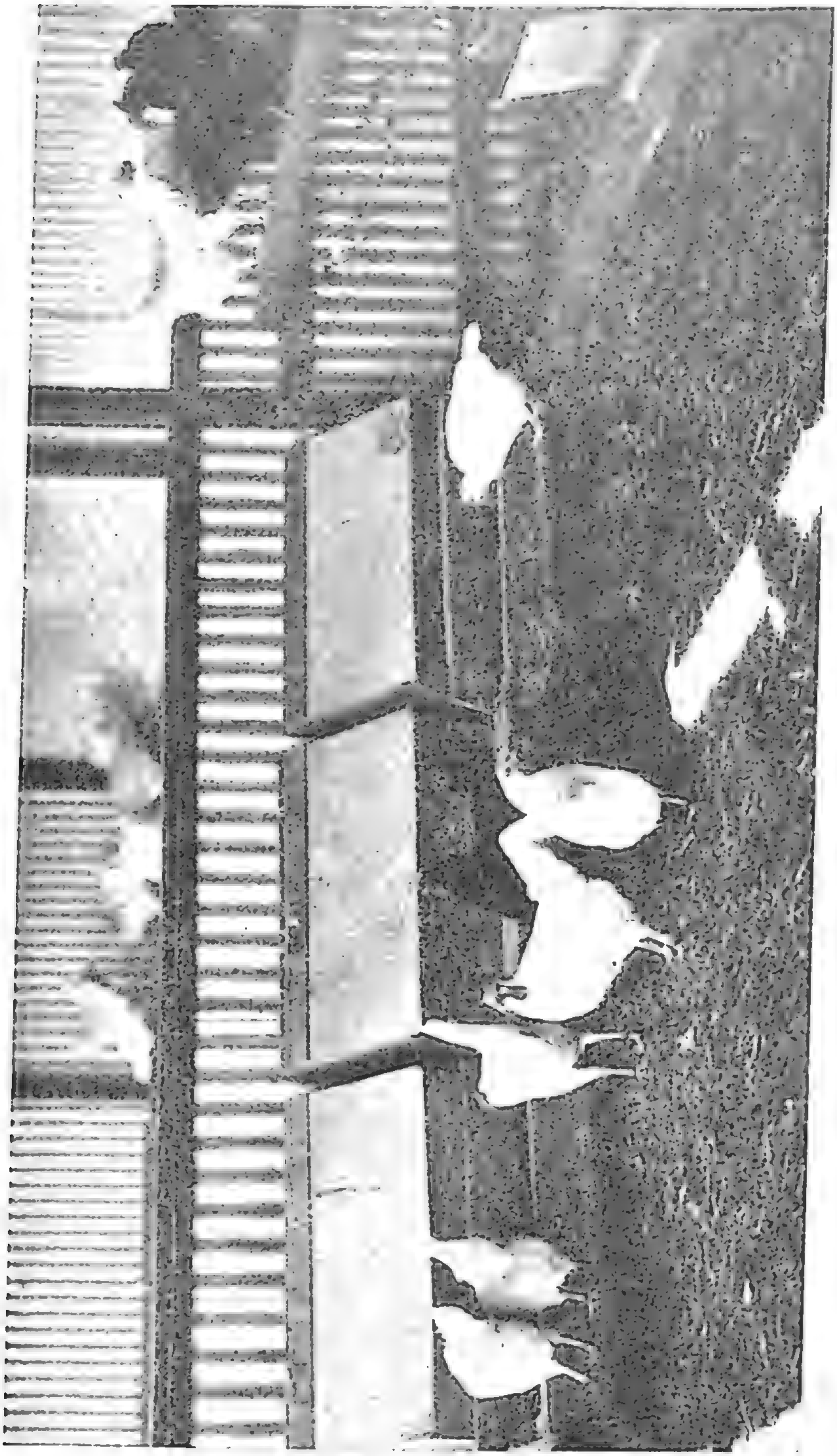


PLATE 98.

Automatic feeding hoppers in use on a poultry farm near Brisbane.

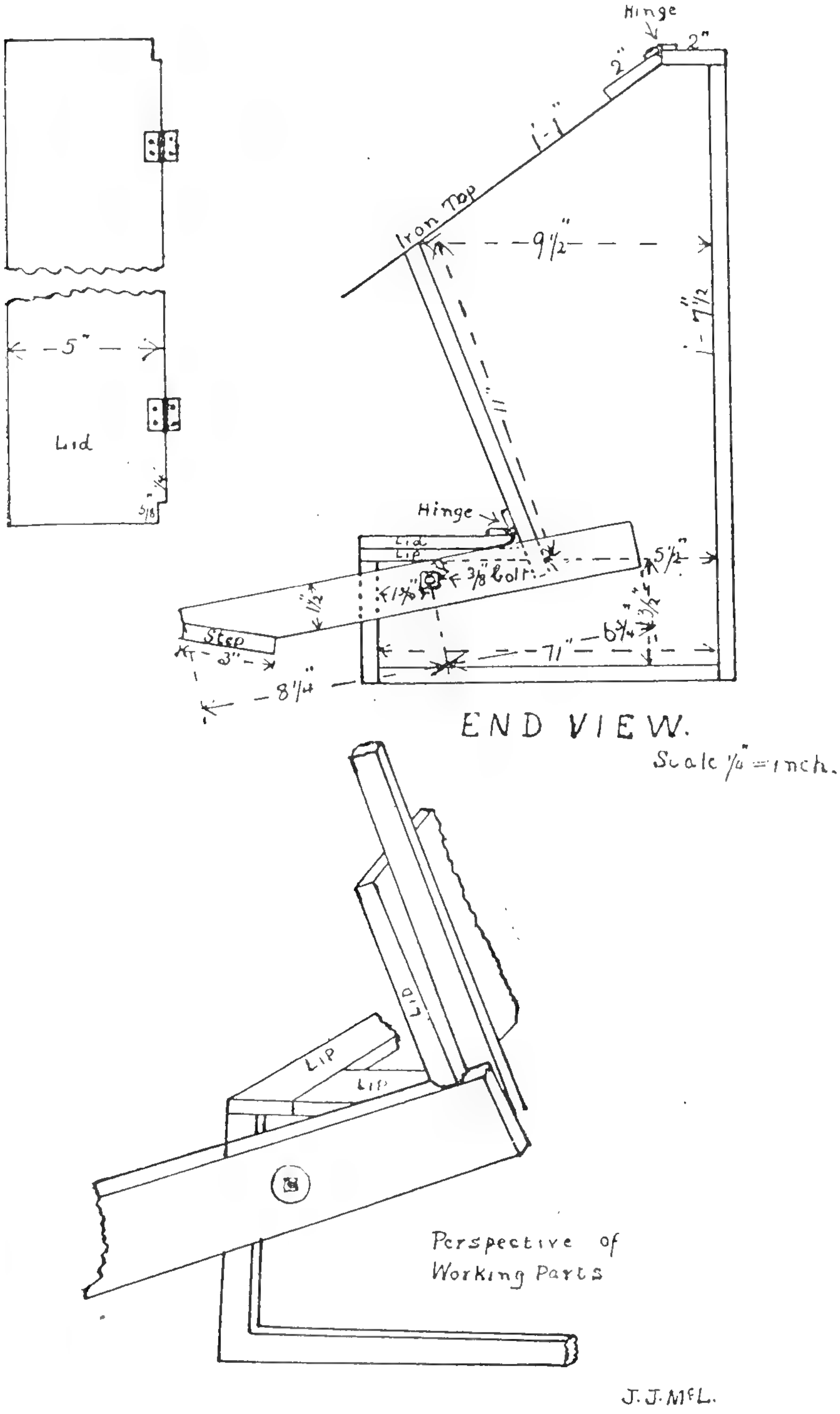


Plate 99.
Plan of automatic feeding hoppers as illustrated.

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The first call upon the food supply is for that of vital functions, then growth, and any surplus nutrients used in the manufacture of eggs. It will therefore be seen that the greater the production the greater will the consumption be, and that egg production is only possible by feeding quantities of food in excess of body requirements. It is generally estimated that a hen in full lay will consume approximately 2 ounces each of grain and mash per day. This quantity, however, will be in excess at times, and again be deficient during the period of peak production.

The majority of cereal foods available are generally deficient in protein, and in preparing a ration it is necessary to use protein-rich foods in the form of milk, milk powders, and meat meal. Protein-rich vegetable foods are available, but it has been found from experience that animal proteins give better results than vegetable. This probably is due to their greater palatability and to the fact that the range of animo-acids is wider. From practice it has been found that rations having a total protein content of 15 per cent. give satisfactory results. As protein-rich foods are the most costly, it will readily be understood that the object of the feeder shouid be to use the minimum quantity necessary for maximum production.

The poultry raiser who does not desire to prepare his own ration may purchase laying mashes to be fed in conjunction with grain, also all-mash. These laying mashes have approximately 18 to 20 per cent. of crude protein, and when fed in conjunction with grain, say equal parts of maize and wheat, the total crude protein content of the ration is reduced to the vicinity of 15·5 per cent.

In addition to the protein and carbohydrate, the mineral content of the layers' ration has to be taken into consideration. The average amount of carbonate of the egg shell is one-fifth of an ounce. To supply the requirements, say, in the mash, 4 per cent. of calcium carbonate would be necessary, but as hens not laying would only void the material it is a better practice to have shell-forming material in the nature of limestone and shell grit always before the bird in separate receptacles.

Commercially, yolk colour does not appear to have as yet caused us any concern, but the consuming public do not like an excessively pale-yolked egg, and to overcome this green feed and yellow maize should form a definite part of a laying ration. Both foods are rich in vitamins, and green feed materially assists in supplying the mineral requirements of poultry. In the absence of green feed lucerne chaff or meal should be used.

The manner in which layers may be fed varies. All systems previously referred to have been proved successful. The most popular at the present time is the feeding of dry mash and grain, although all-mash is coming more into vogue. For those who desire to prepare their own mixture the following rations are suggested as a working basis:—

Ration—Grain and Mash.

Mash.	Per cent.	Grain.	Per cent.
Lucerne chaff or meal	10	Wheat	50
Bran	28	Maize	50
Pollard	30		
Maize meal	20		
Linseed	2		
Meat meal	10		

Supplements to each 100 of mash—

½ lb. Salt.
2 lb. Bone Meal.
1 per cent. Cod Liver Oil.

All Mash.

	Per cent.
Meat Meal	5
Lucerne Chaff	6
Linseed	1
Maize Meal	30
Bran	20
Pollard	40

Supplements—

Bone meal	2 lb.	To every 100 lb. of Mash.
Salt	½ lb.	
Cod Liver Oil	1 lb.	

Care of Moulting Hen.

It is a common practice among breeders to give little attention to moulting birds. In many instances they receive nothing but a grain ration. Feathers contain a considerable amount of protein, and the most economical manner of getting birds back into production is to feed protein-rich foods as provided in a laying ration. Moulting may be induced by the feeding of nothing but grain at or about the time birds usually moult. When once the moult has commenced laying rations should be supplied, as it will take about a fortnight for the manufacture of the first egg after the moult is completed.

Fattening.

Two classes of birds have to be considered—old hens and cockerels. The ability of the feeder to do much with old hens in good condition is questionable, but those slightly out of condition could be improved with ten to fourteen days' crate feeding. From experiments that have been conducted it has been found just as economical to rear cockerels to the various marketing stages on the growing rations used for pullets. Ten to fourteen days crate feeding of these birds would undoubtedly add to their market value. As the old hens or young cockerels are to be handled they should be freed of external and internal parasites before being submitted to a fattening process. The crates could be small coops 2 feet wide, 3 feet deep, and 3 feet high. These crates would hold about six birds for the period, and if the floor is wire netting and off the ground, the evacuation would fall through and the birds be kept clean. The front should be of wire or slats wide enough apart for the birds to get their heads through to enable feeding from a trough in the front. An all-mash mixture of a relatively high protein content fed as a gruel three times a day will undoubtedly improve condition. With this system of feeding water is not necessary. Any food left over, say, after half-an-hour should be removed in order to keep the appetite keen. A mash of equal parts maize meal and pollard, plus 10 per cent. butter milk powder and 5 per cent. meat meal, is suggested.

Preparation of Mashes.

On the majority of farms the various ingredients that go in the making of mash are either mixed with a shovel upon the floor of the feed room or in some trough.

If the mash is to be fed wet it is a good idea to soak the lucerne chaff or meal in water over night. Just sufficient water should be used to make the mash of the correct consistency and the salt used in the mixture dissolve in the water first. This ensures an equal distribution.

In making a dry mixture the salt should be added to the protein-rich foods in order to increase the bulk through which the salt is distributed. This action ensures an even distribution of salt throughout the mash.

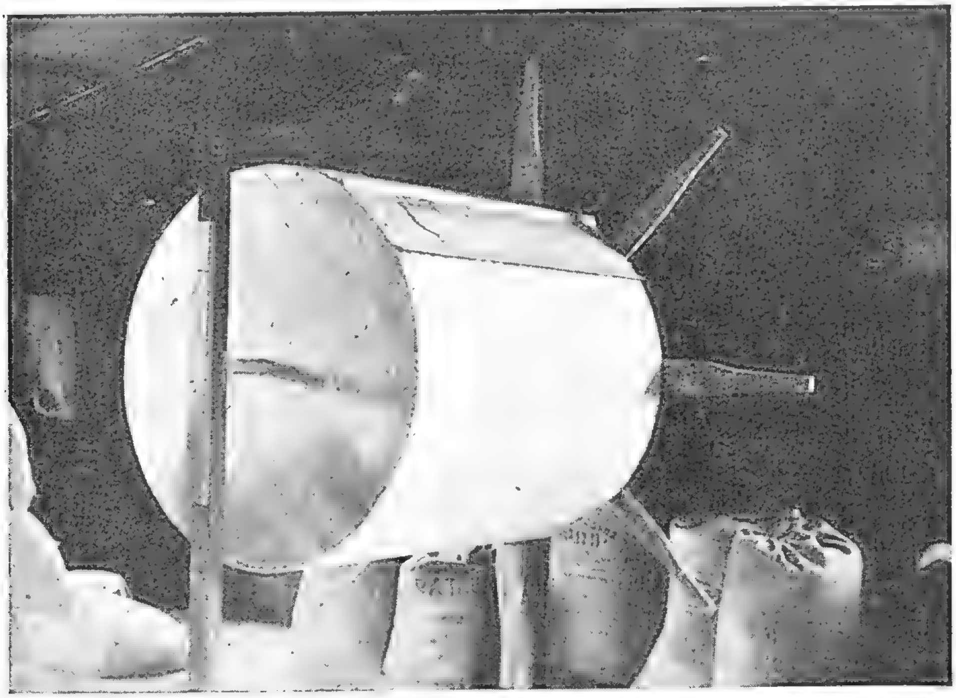

PLATE 100.
A handy mash mixer.

When using cod liver oil, to ensure an equal distribution it will be found most convenient to incorporate it in the bran in the first instance.

Much labour will be saved and better mixing of the various ingredients ensured by using a mash mixer. An appliance that serves the purpose is easily constructed by the poultry raiser. The mixer consists of a drum constructed of 22-gauge galvanised sheet iron with tongued and grooved pine ends, as illustrated. A pipe of 1¼-inch diameter is passed through the centre of the drum, fitting into hardwood bearings at each end. This pipe can be keyed to the drum by boring a hole through the pipe close to the drum and using a piece of No. 8 wire as a key. Naturally, the No. 8 wire has to be bolted to the drum.

The mash is mixed by a tumbling process, and to assist in raising the mash on the side of the drum while it is revolving four battens should be attached lengthwise inside the drum 2 inches from the iron. The battens should be of 2½ by 1-inch timber. They are necessary for the thorough mixing of dry mash.

The diameter of the drum is 3 feet 6 inches, and the length equal to the width of the iron. The sheet iron to pass around the drum will

have to be riveted end to end, and the sides attached to the pine ends every 2 inches with screws. A convenient size opening, the full length of the drum, must be left for filling. A sliding close-fitting door must be provided.

Dry-mash Hoppers.

It is most difficult to design a dry-mash hopper that is thoroughly efficient in all respects; however, the accompanying illustration will prove quite satisfactory. This hopper, being wider at the bottom than the top, tends to obviate the trouble of mash sticking up, which is so common in other designs. In addition, the lip on the feeding trough will prevent much wastage of mash. Such a hopper could be built in lengths to suit the number of birds, allowing 1 foot of feeding space to every ten birds. The feeding space, however, could be increased where all-mash is fed by allowing 1 foot to every eight birds.

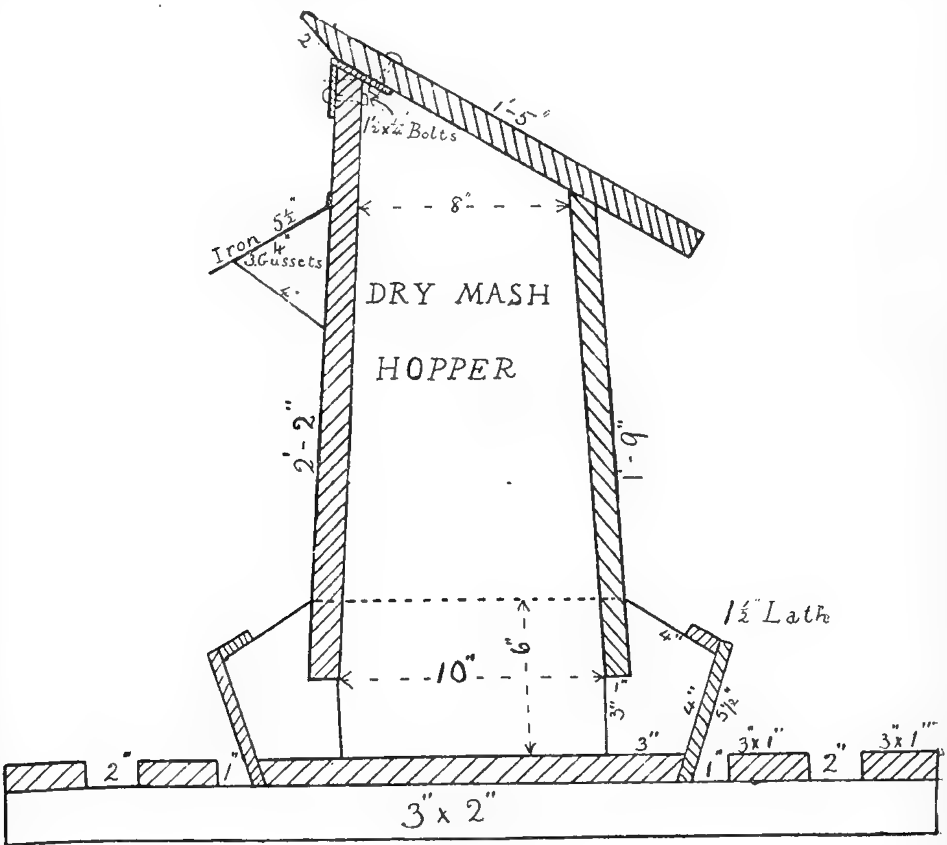

Plate 101.

Wet mash should be fed in troughs or on a sheet of iron; after the birds have consumed the mash these receptacles should be stood up to avoid contamination.

Turkey Feeding.

No food should be given for at least forty-eight hours after hatching. Hard grit, charcoal, and water should be the first food provided. The hard grit assists in mastication, and charcoal has no equal as a bowel corrector. Turkey chickens will gorge themselves if allowed, and this

gorging is responsible for a considerable amount of trouble. Turkeys in their wild state would gather their food very slowly, and it is found best to imitate them as far as possible by feeding the young chickens only a little at a time, and fairly frequently. This prevents them from overloading their digestive organs, and helps to retain that keenness of appetite which is essential to success.

Stale bread soaked in milk and then squeezed fairly dry is the most handy food on the farm, and also gives excellent results. This can be fed five times a day for a few days, and variety can be added by the replacement of some of the meals with chick grains, mashes of bran and pollard mixed with milk, to which can be added a small amount of minced meat, and tender green feed. This mash should be made crumbly and not sticky.

When on range the quantities of food will vary according to what they can gather for themselves, but surplus milk can be fed at all times either thick or fresh, but it is as well to always feed it in the same condition. Green feed should be fed in abundance to both growing and adult stock, but where range is allowed on good green pasture it is not so important.

Grains should always be fed at night, and so induce the flocks to return to their camps. Oats, maize, and wheat are suitable for this purpose.

In the management of turkeys, especially in the rearing of young stock, cleanliness is essential. Food should not be allowed to lie about or become decomposed, and a strict outlook must be kept for vermin of all sorts.

Duck Feeding.

Ducklings require no feed for forty-eight hours after hatching. During this period they should have water, coarse sand, and charcoal constantly before them. A mash that will give good results if fed from the first meal until they are about four weeks old is prepared by mixing together—pollard, 10 lb.; maize meal, 8 lb.; dried butter-milk, 2 lb.; bonemeal, ½ lb.; fine salt, 2 ounces. If this mash was mixed, the amount for each meal could be moistened as required. Feed several meals daily—a little, and often, is a good motto. After four weeks they could be fed a mash similar to that fed to the adults.

Adults mash—

	Per cent.
Pollard	55
Bran	25
Maizemeal	10
Meatmeal	10
Bonemeal	1
Fine Salt	½

Feed growing stock three meals daily. With adults, a small meal of whole maize could be fed in the evening in addition to the mash. In fattening ducks, cheap foodstuffs in the form of potatoes, pumpkins, &c., could be boiled and added to the mash to the extent of 40 per cent. Chaffed young greenstuff should be added, but when using other cheap foodstuffs omit it, otherwise the mash would be too bulky.

Water.

Ducks must always have access to drinking water. This is *most important* with ducklings, and the water vessels should be deep enough for them to submerge their heads. Many ducks die annually, and the cause can be attributed to lack of water.

COMMERCIAL FOODS AND THEIR FEEDING VALUE.

Barley.

Not a popular food among poultry-keepers nor do fowls consume it readily. It has a fair feeding value, but in order to increase its palatability it should be soaked or sproated. When corn and wheat are high in price, barley could be used to the extent of 50 per cent. of the grain mixture, but the change over should be gradual.

Beans and Peas.

When whole, stock do not take kindly to either of these grains; crushed they add to the protein content of the mash, and may be used to the extent of 10 per cent.

The Grain Sorghum.

In the drier areas this crop can be grown successfully when maize or wheat are failures. They are slightly higher in protein content than maize, but do not contain the fats. Feterita and Milo are preferred, and are extensively used by some breeders with a good deal of success and economy in feeding. Some varieties of the grain, notably Kaffir corn, are credited with a binding effect on the bowels, but as an offset against this plentiful supplies of green feed can be used.

Maize.

This is one of Queensland's staple grain crops of which poultry are very fond. Large grain needs to be cracked, but the smaller varieties can be fed whole. When purchasing maize for grain feeding, it is as well to try and secure the small whole grain. The quality is then easily judged, and there is no waste. Cracked grain should always be sieved before being used, and the fine powder used in the mash. If the grain is fed extensively, it is inclined to lay on internal fat, but it can be used to the extent of at least 50 per cent. of the grain ration with safety. Yellow corn should be used in preference to the white on account of its content of vitamine A.

Oats.

In some places oats is one of the principal poultry foods. Most of Queensland's supply is, however, imported, and it therefore cannot be used economically in large quantities. It is, however, desirable to add variety to the ration of breeding stock by using a proportion of this grain.

Rice.

In the northern portion of Queensland, where this grain is grown, it may be possible to use quantities economically. It is a very starchy food of a fattening nature, but can be used to the extent of one-third of the grain ration. Crushed or ground rice needs to be used with care, owing to its tendency to go rancid.

Wheat.

This grain provides the bulk of our poultry food supplied. It is readily consumed by poultry, and can be fed as a part of any grain ration or used by itself, the market price of various grain foods available being the guide as to the quantities used. Plump wheats of a hard nature are of better feeding value than pinched grain or full soft grains.

Bran.

Bran is rich in protein and mineral matter, but carries a fair quantity of fibre. This fibre is useful in adding a certain quantity of bulk to the ration. It also assists in making a mash when fed wet of a nice consistency. Use at the rate up to 30 per cent. of the mash.

Pollard.

Pollard has a greater proportion of carbohydrates than bran, but not so much ash and fibre. It forms the principal constituent of mashes, and may be used to the extent of 60 per cent. of the total mash supply.

Maize Meal.

This meal is of especial value in fattening poultry. Certain quantities should be used in all mashes.

Ground Oats, Rolled Oats, and Hulled Oats.

Ground oats—that is, oats without the hulls—is an excellent food for both laying and growing stock, being rich in protein. The use of these foods is largely governed by the price.

Linseed Meal.

Fairly rich in oils and proteins, but contains a good deal of fibre. It may be used to the extent of 2 per cent. in the laying mash, and increased slightly during the moulting period.

Cotton Seed Meal.

Cotton seed meal, on analysis, would appear to be a splendid food for poultry, but in practice the extensive use has not given good results. A good grade may be used to the extent of 5 per cent., but never exceed this quantity.

Peanut Meal.

A very nitrogenous and easily digested meal. The keeping quality of the food is poor, being inclined to go rancid, but it may be used to assist in building up the protein content of mashes.

Meat Meals.

Meat meals vary considerably in their analysis. They are essential for high egg-production. The quantities to be used would vary according to conditions under which poultry are kept. In closed runs where no other class of animal food is available, they may be used to the extent of 10 per cent., but with stock on free range during periods when animal food in the form of insect life is plentiful, the quantity should be considerably reduced.

Dry Crushed Bone and Bone Meal.

These materials are essential for the development of the bony structure of young growing stock and beneficial to laying birds. Quantities up to 5 per cent. may be used. Poultry keepers who are a distance

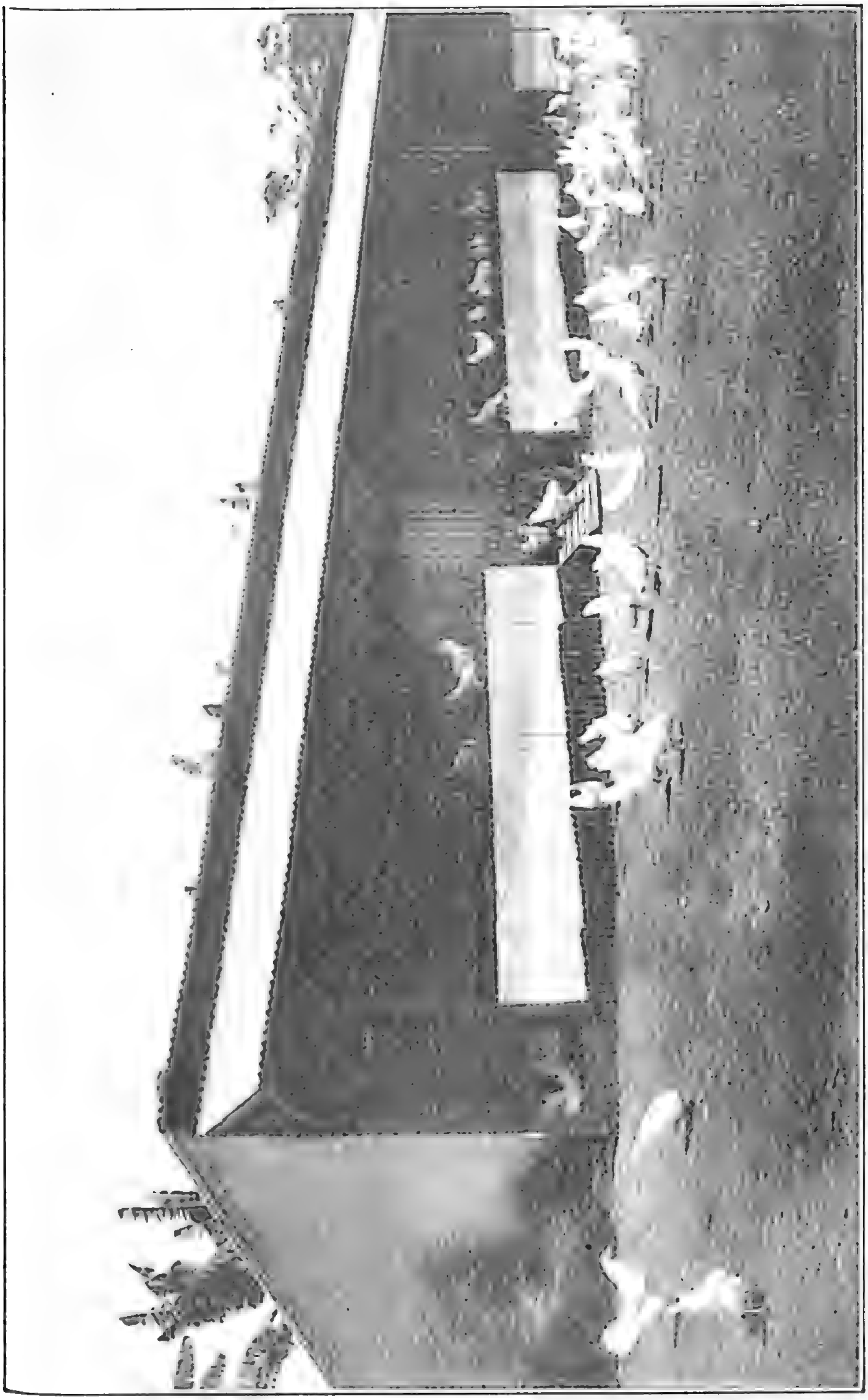

Plate 102.—An intensive laying house on a poultry farm near Brisbane, built according to the plan shown on page 169 of the February issue of the Journal.

from markets could burn any bones about the place, which renders them easily crushed, and so have a supply of mineral matter suitable for feeding to young growing stock.

Milk.

If all poultry keepers had a good supply of skim milk or butter-milk there would not be such a large number of poorly developed stock on our farms. There is no better animal food for stock than milk or milk products. In a sour state it is recommended by some authorities as preventative of diarrhoea and coccidcosis. In feeding, however, vessels need to be kept clean, and although the milk is being fed in a sour state, putrification needs to be avoided.

Dried Buttermilk.

This is an excellent food for those who have not the fresh product, and in a State such as Queensland, where the dairying industry is so extensive, poultry breeders should be assured of a continuity of supplies. Milk and milk products appear to be a tonic as well as a food, and highly suited for laying stock, growing stock, and breeding stock. When used for the latter purposes, it has been our experience that the hatchability of the eggs has been increased. It may be used as the sole source of animal food, or in conjunction with other forms of animal food. The price will govern its use.

Green Feed.

Some sort of succulent green food is essential to maintain the health and vigour of stock, not so much by reason of its nutritive value, although certain quantities are supplied, but to act as a natural tonic on the fowl's system.

It has long been recognised as an important food for poultry, but it is only during recent years that scientists have found that green foods have been supplying an element essential to life. Green feed stimulates the liver and increases the secretion of digestive juices. The kinds of green feed most valuable and relished by fowls are the young, tender-growing portions of lucerne, lettuce, kale, rape, silver beet, barley, oats, maize, &c. In fact, all green foods are good, but it should be young or tender. The quantity used is dependent upon supplies and general conditions. When feeding by itself, say, at midday, give the birds as much as they will eat. If used in a wet mash, the quantity could be as high as 25 per cent. of the bulk, and during droughty periods, when poultry foods are costly, green feed can be used to the extent of 60 per cent. of the mash; but when fed in these quantities, two mashes, one at 7 a.m. and one about 1 p.m., should be fed daily, followed by a grain feed, say, at 5 p.m. Poultry have not a great holding capacity, hence the necessity of feeding two mashes to enable them to deal with the necessary bulk to obtain all the nutriment required.

When fresh green feed cannot be obtained, lucerne chaff or meal make an excellent substitute. This class of food, being dry, however, cannot be used to the same extent as if green. By weight, 12 per cent. should be the limit. If feeding on the wet mash, the dry lucerne can be soaked over-night with just enough water to mix the mash. This softens the lucerne, making it more easily digested.

Grits.

Shell grit, limestone, or crushed bone, for the purpose of supplying the necessary material for bone and egg-shell formation, should be

provided. Plentiful supplies of oyster shell or ground lime should always be available, while bone may be supplied either in the form of meal or grit.

Hard Flinty Grit.

Hard pieces of rock, sand, &c., are necessary to poultry for the grinding of their food, and should also be in free supply, particularly with stock confined to pens. Without grit it is impossible for stock to thoroughly digest their food, and any system of feeding where this is not supplied is wasteful.

Charcoal.

This can be fed either in the mash or be available to stock at all times. When it is desired to feed powdered charcoal in the mash it should be used at the rate of 2½ per cent. Charcoal is valued for its mineral content and its action as a bowel corrector.

In feeding all grit continuity of supply is essential, otherwise stock are liable to gorge themselves, with resulting troubles in the nature of distended crops, &c.

Salt.

With a good system of feeding—that is, variety and plenty of green feed—there is generally a sufficient supply of salt to meet the body requirements, but small quantities, 8 oz. to every 100 lb. of mash, makes the food more palatable, with the result of greater consumption and production. Salt, however, needs to be well mixed with the mash; when wet mash is fed it can be dissolved in the water, but when fed dry too much care cannot be exercised in thoroughly distributing it throughout the mash, owing to its poisonous nature when excessive quantities are consumed by poultry.

Composition of some Poultry Foods.

CRUDE NUTRIENTS.

Food.	Protein.	Fat.	Carbo-hydrates.	Fibre.	Ash.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Barley	8·6	1·5	71·0	2·7	2·2
Beans	25·4	1·5	48·5	7·1	3·2
Kaffir corn	9·9	1·4	74·9	1·5	3·0
Maize	9·5	4·0	69·3	2·8	1·4
Oats	10·3	4·8	58·2	10·3	3·1
Rice	7·6	1·9	66·7	9·3	4·9
Wheat	12·8	2·0	67·7	2·4	1·7
Bran	15·8	2·6	56·3	9·8	4·9
Cotton-seed meal (decort.)	41·0	7·0	29·0	8·0	6·0
Linseed meal (new process)	27·2	0·8	40·7	13·9	6·2
Maizemeal	8·6	3·7	71·4	2·0	1·3
Peanut meal	47·6	8·0	23·7	5·1	4·9
Pollard	15·7	3·6	61·4	5·8	3·1
Meatmeal	54·4	8·0	6·1	..	23·5
Skim milk	3·8	0·1	4·9	..	0·8
Dried buttermilk ..	34·5	1·1	49·1	..	8·3
Lucerne chaff	20·7	1·4	40·9	20·0	9·0

Queensland Weeds.

By C. T. WHITE, Government Botanist.

BLUE WEED OR PATERSON'S CURSE (ECHIUM PLANTAGINEUM).

Description.—An erect herbaceous weed, mostly 1 to 2 feet high, but sometimes much larger under favourable conditions of soil and climate; stems and leaves covered with rather long, stiff, scattered, rough hairs. Radical leaves large and sometimes dying-off in the older plants; stem leaves narrowly oblong in shape, cordate at the base, pointed at the apex, 2 to 4 inches long. Flowers purplish-blue, borne in dense clusters (one-sided cymes) at the ends of the main branches and upper side branches. Calyx green, hairy, divided nearly to the base into five segments, one-third to half an inch long. Corolla purplish-blue, but sometimes purplish-red, or even white, about 1 inch long. Stamens five, two of them longer than the others and exserted. Seeds (nutlets) borne in fours inside at the base of the calyx, small, only about 1 line in diameter, angular and very tuberculate (rough).

Distribution.—A native of the Mediterranean region, now a common naturalised weed in Australia. It is said to have first been introduced into Victoria as a garden flower about 1875, but it was not reported to be spreading as a weed until about 1896. From then on its spread in Victoria, South Australia, and New South Wales was increasingly rapid. It is difficult to say when it first came to Queensland; the earliest record in our collections is 1916, when we received specimens from Yandilla.

Common Names.—In New South Wales and Victoria it is commonly known as "Blue Weed" or "Paterson's Curse." In South Australia it is most generally known as "Salvation Jane." In England and America species of *Echium* are commonly called "Bugloss" or "Viper's Bugloss."

Botanical Name.—*Echium,* the ancient Greek name of a plant of this family, and derived from *Echis,* a viper, from the resemblance between the seeds and the head of a viper (J. C. Loudon) ; *plantagineum,* Latin in reference to some similarity of the leaves to those of the genus *Plantago,* which contains the plants variously known as Rib Grasses, Plantains, Lamb's Quarters, &c.

Properties.—It is not known to possess any harmful or poisonous properties. The first leaves are succulent and palatable, and stock will eat them readily enough, but the plant soon becomes harsh and is left entirely alone. I have heard it spoken well of as a bee plant.

Eradication.—At the present time the areas infested in Queensland are probably not so great but that they can be hand-treated by cutting off the plants well below the surface of the ground.

Botanical Reference.—*Echium plantagineum* Linnaeus Mantissa II., 202.

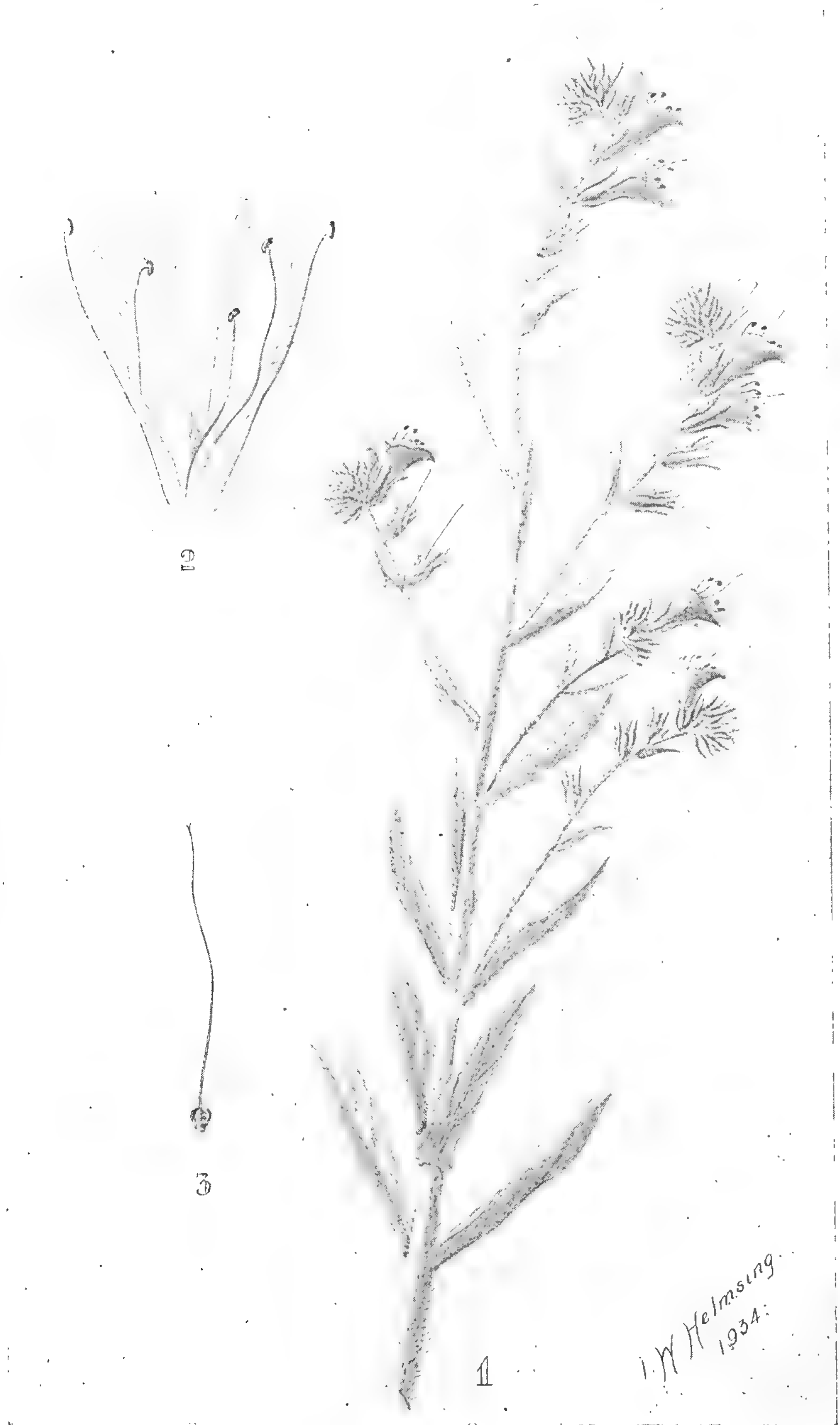

PLATE 103.—BLUE WEED OR PATERSON'S CURSE (*Echium plantagineum*).
1. A flowering stem (approximately half natural size). 2. Flower (Corolla) laid open × 2. 3. Pistil × 2.

Agricultural Notes.

By H. S. HUNTER, Agricultural Branch.

SEASONAL PROSPECTS.

UNLIKE the two preceding seasons, the normal late-summer rains, on which so much depends for the winter months, have not failed to materialise. Copious and widespread rains in February, over practically the whole of the State have guaranteed a continuance of the favourable season. Since April, 1933, when belated monsoonal rains brought relief from a severe dry spell, the agricultural areas of Southern Queensland have received rains at frequent intervals, which came, in many cases, at an opportune time to prevent any serious setback to the growing crops. Since the breaking, last year, of the long drought in the Central district, that area also has experienced a run of favourable weather.

Last month's general rain resulted in the disappearance of the remaining stronghold of drought, in the Winton-Hughenden area, and pastoral and agricultural Queensland now is in such shape as to view the approach of the autumn and winter months with confidence. Provided the appropriate farming operations for the system of short-fallowing and moisture conservation are given effect to, the advent of seasonal rains in late summer has an important bearing on the successful growing of winter cereals, in that the autumn and winter months normally do not yield sufficient moisture for the needs of wheat and like crops.

It is inevitable that some damage would be sustained by heavy rains at the present time, especially in the agricultural districts. Severe flooding occurred on two occasions during the month in parts of the far North Coast.

Sugar.

Continued rains in the far North provided conditions which were favourable for crop growth except where the control of weeds has not been possible. Temperatures have been abnormally low throughout February, so that the cane growth has not been so vigorous as is normally experienced at this season.

In Mackay and Bundaberg a dry spell was experienced in mid-February which caused a temporary check to the cane crops, but the beneficial rains of the past week have enabled them to recover, and good yields may now be expected in these districts.

Early forecasts for Queensland as a whole suggest that a further heavy crop will be harvested; it is as yet too early to state whether it is likely to exceed that of 1933.

Maize.

Extended areas and a favourable growing season are factors which indicate that a heavy yield may be expected this season. Some losses may have been sustained in low-lying areas in the coastal districts from floods, especially where the maize had lodged from the effects of previous heavy rains.

Harvesting of the mid-season crop now is general, particularly on the Darling Downs, where extended plantings were made this season. Consignments totalling 200 tons of maize, mostly to Southern States, are reported to have left the Allora district alone within the first two weeks of the month.

Continuous wet weather hampered planting operations on the Atherton Tableland, where the area under maize is estimated at 16,000 acres, or 4,000 acres less than last season.

Cotton.

The late February rains were urgently needed in most cotton-growing districts to develop the top crop of bolls, and it now is practically certain that a record yield for the State will be obtained. With average conditions for the rest of the season excellent crops are expected, especially in the Upper Burnett, where a large acreage of medium to late-planted cotton exists.

Where proper cultural practices have been adopted, good yields from early-planted crops also are in prospect. Many nicely developed early planted crops are to be seen in the Mundubbera and Callide Valley districts.

An outstanding feature of the season, in most districts, is the pronounced freedom from attacks by the corn ear worm, which often has caused damage in past years. The lack of damage is noticeable particularly where clean cultivation has been maintained. Where severe attack from corn ear worm occurs, it frequently is found that the fields are infested with pig weed and bull head, both of which weeds are attractive to the moth of this pest.

The ginneries now are open for receipt of consignments of early cotton, which is being harvested in the Central district. Harvesting should be more general within the next few weeks and will extend to about July at the earliest.

It is pleasing to note that arrangements have been made whereby it will be possible for the Australian cotton spinners to contract to buy 12,000 bales of cotton from the coming harvest.

Tobacco.

The season, so far, has been most discouraging for the tobacco grower due, principally, to the difficulty of raising seedlings, owing to the prevalence of blue mould. The infestation of this disease has been particularly severe in most districts, the humid conditions having been conducive to its development.

In many cases where the Department's recommended preventive sprays have been carefully used, success has attended the efforts to raise seedlings, but very often these measures have been rendered ineffective by rain washing the spray material from the plant.

In the Mareeba district, plantings which were effected in November and December have reached the curing stage and are resulting in the production of exceptionally bright leaf, with an encouraging absence of the spotting trouble which was so prevalent during the past two seasons.

However, in the majority of instances, shortage of plants has unduly delayed transplanting, and at the commencement of the month the area planted would not exceed 600 acres, or less than half the area planted at the corresponding time last year.

In the tobacco areas to the hinterland of Townsville, blue mould interfered with planting operations, notably at Hervey's Range, where the growers are endeavouring to raise a fresh lot of seedlings in time for planting out. Better success has been obtained in the Woodstock, Sellheim, Ravenswood, and Charters Towers districts, where some of the crops have made excellent and uninterrupted growth with a noticeable absence of leaf spot.

In the Southern areas, the delay in transplanting is more serious, owing to the danger that the crops will encounter frost. Blue mould has been the main trouble at Beerburrum, Park Ridge, and in the Texas and Inglewood districts. In the latter two areas, where tobacco is grown under irrigation, the unusually heavy rains have caused losses in the field from stem rot.

Numbers of growers, chiefly share-farmers, have ceased operations in the Texas and Inglewood districts and this fact, together with losses from disease, has accounted for a considerable reduction in the collective area, which is calculated at about 450 acres or less than half that of previous seasons.

Leaf, which is now being cured from the early plantings, is showing better colour than usual.

TOBACCO—TOPPING AND SUCKERING.

The main object of topping and suckering tobacco is to hasten maturity. These practices are also important factors in the production of quality leaf, writes the Tobacco Expert of the New South Wales Department of Agriculture in current notes.

The natural thing for the tobacco plant to do is to set seed, but by removing the flower head (i.e., topping) as soon as it appears, seed setting is prevented and much of the plant-food material that would have been used up in seed formation will be made available for leaf development. Tobacco plants that are allowed to go to seed or produce suckers have thin papery leaves of poor texture, body, and weight.

Topping results in lateral shoots soon making their appearance at the leaf axils and at the base of the plant. Naturally, if these are not removed they also will develop and set seed heads at the expense of the tobacco leaves.

To determine at what height the plants should be broken off it is essential that the vigour of the plant be first carefully observed, and the earliness or lateness of the season should also be taken into account. Then, too, the question of obtaining uniformity in ripening over a fair area of the crop to facilitate an even and sufficient picking for flue-curing must be considered.

With well-grown and early light and bright types of tobacco it is usual to leave about fourteen or fifteen leaves to come to maturity. With late tobacco it is often advisable to leave only nine or ten leaves, excluding the damaged bottom leaves.

Many growers do not fully realise the damage they are doing to their crop in allowing suckers to grow too large. Suckers should be removed as soon as they can be conveniently grasped in the fingers and not permitted to grow longer than 2 inches.

Seasonal Notes.

By H. W. BALL, Assistant Experimentalist, Agricultural Branch.

CULTURAL operations in the wheat areas will now be well advanced, and care should be taken to see that workings become shallower as seeding time approaches.

Spring tooth and rigid tine cultivators are preferable to disc implements for working the fallows.

A late disc cultivation does considerable harm by spoiling the necessary consolidation.

If sheep are given access to the paddocks, they can be of great assistance in keeping down weed growth, thereby reducing cultivation and helping to consolidate the soil.

By efficient cultivation much of the heavy summer rainfall can be conserved for use by the future crop.

Where wild oats are a problem and it is not desired that bare fallowing should be resorted to, the infestation can be reduced by sowing an early maturing crop of rye, barley, or wheat as a fodder crop, to provide grazing for sheep, and to be subsequently ploughed in before any grain ripens.

Or, alternatively, the land can be well worked to encourage the germination of the wild oats, which are then cultivated out, and a late sowing made with a suitable variety of wheat.

Suitable varieties of wheat may be sown towards the end of April for hay purposes.

Varieties such as Cleveland and Currawa are also sown with a view to feeding off during early growth to sheep.

The main sowing of lucerne should be made during the March-April period.

Lucerne prefers a fine, well-prepared seed-bed, preferably in a calcareous soil, and the value of the crop well repays a little extra trouble at the beginning.

As weed growth is not so pronounced during the winter months, the young lucerne has an excellent chance of becoming established if sown at this time.

It has been found that lucerne is a valuable crop to sow for grazing in the outlying farming areas and pastoral country, having a rainfall in the vicinity of 20 to 25 inches per annum.

A light seeding of 3 to 4 lb. per acre is sufficient to produce a stand, which, if judiciously grazed, will carry considerably more stock per acre than the natural pastures, particularly during the winter months.

CAULIFLOWER CULTIVATION.

Supplied by the Fruit Branch.

THE colder months are the best for the growing of cauliflowers, and it is necessary, therefore, to plant out in time to ensure their heading during that season.

In the southern coastal districts the planting of the seed is done between February and April, the Tableland districts from February to May, and the inland districts from February to March. In the northern district from February to May on the coastal, inland, and tableland areas.

Cauliflower plants are usually raised in seed-beds. The beds should be well prepared, and if the soil is too heavy it may be improved by adding other soil of a sandy nature. The soil should be finely raked and the seed sown in drills about a foot apart and covered with about a quarter of an inch of soil or well-rotted manure. When the young plants appear they should be kept well watered, and within four or five weeks they should be ready for planting out. This is best done under moist conditions. Care is essential in removing the young plants from the beds, and the young roots of the plants should be kept moist at all times.

The Agricultural Chemist in his pamphlet on complete fertilizers states:—Cauliflowers require a very rich loam and a heavy dressing of farmyard manure.

When using from 10 to 15 tons of stable manure per acre, when the ground is being prepared, the following mixture of artificial fertilizers should be applied per acre when planting:—

3 to 4 cwt. of nitrate of soda.
4 to 6 cwt. Nauru phosphate—superphosphate mixture.
1 to 2 cwt. sulphate of potash.

The latter to be applied in top dressings. Without farmyard manure use, per acre—

4 cwt. of nitrate of soda or sulphate of ammonia,
6 cwt. of Nauru phosphate—superphosphate mixture,
2 cwt. sulphate of potash

when planting, and two or three top dressings of 1 cwt. of nitrate of soda each.

While the plants are growing, cultivation should be thorough but should cease when they begin to head, because cultivation at this stage causes the head to become loose and coarse.

To keep the head white it is necessary to protect it from the sun, and this is done by tying the tops of the leaves together over the head as soon as it begins to form. Cutting the heads for market is best done in the morning, and care must be taken not to bruise them, for each bruise appears as a black mark.

Cauliflowers should not follow a cabbage crop or occupy the same ground for two consecutive seasons. Cauliflowers are usually planted in rows 3 feet apart, with 2 feet between the plants, and 1 lb. of seed planted in drills is sufficient to plant an acre. Varieties recommended are Primus, Early and Late Phenomenon, and Eclipse.

CARE NEEDED IN BRANDING PIGS.

Reporting to its shareholders recently, the North Queensland Co-operative Bacon Association, Limited, advised that an appreciable number of the pigs forwarded for slaughter have been treated too severely in branding, the branding having been carried out too heavily, causing loss in the finished article, hams and bacon, through the manufacturer having to cut out the portion which has been too deeply branded, thus reducing the commercial value of the side, flitch, or ham respectively.

Improper fire branding of pork and bacon pigs inflicts a heavy loss on the bacon trade annually. It has been definitely proved that body tattoo branding is much to be preferred to fire branding, and this system is now being advised by the majority of factories and is practised by all the principal buyers of market pigs.

COLD STORAGE OF FRUIT—KEEPING QUALITIES OF DIFFERENT VARIETIES.

It is well known, observes a pamphlet issued by the New South Wales Department of Agriculture on the cold storage of fruit, that the keeping quality of similar varieties of fruit grown in the same orchard does not remain constant. It may vary from season to season. It depends upon (*a*) soil, (*b*) rainfall, (*c*) care in handling, (*d*) size of fruit, and possibly upon other factors.

Generally speaking, if the cool store is operated upon proper lines, very little loss will occur, always supposing that the fruit has been picked at the right stage of maturity and handled carefully, and that conditions were studied carefully during the growing period. When light crops are harvested and the fruit is large it will not keep so well as when the crop is normal and the fruit is of medium size. Since heavy rain immediately before picking prejudicially affects the keeping qualities of fruit, in a wet season careful watch should be kept on the fruit in storage. It is recommended by some that in such a season the temperature in the cool chambers should be maintained slightly higher than in a season of normal rainfall.

The information at present available concerning the keeping quality, &c., of the different commercial varieties of fruits is summarised as follows:—

APPLES.

Jonathan.—A good storer if picked when well coloured. Large fruit goes "sleepy" if held any length of time. Jonathan spot causes losses and should be closely watched. This variety does not scald to any extent.

London Pippin.—Holds until November if picked when the ground colour is changing and placed in store straight from the tree.

King David.—Stores well in some seasons, but not a very sound variety to rely upon.

Delicious.—If picked when well coloured and placed in store straight from the tree, it will hold up well till October or November. Flavour improves in store.

Tasma.—A splendid storer, which keeps well till the last, except oversized fruit from young trees, which goes "sleepy."

Yates.—A splendid storer, which keeps to the last.

Dougherty.—Stores well sometimes, but not a very sound variety.

Granny Smith.—The general practice is to pick this variety in April and leave in well-ventilated stacks until June, by which time the skin developes an oily feeling. The fruit is then wrapped in oiled paper and placed in store. It holds well till December. This variety should never be stored except in oiled wrappers, otherwise scald is likely to develop when the fruit is removed from the store.

Rome Beauty.—Stores satisfactorily when well coloured, but should not be held too long.

Rokewood and Grafton.—Both store very well.

Stayman Winesap.—Goes "sleepy" if held too long and consequently should be cleaned up by the end of July.

For long storage, apples and pears should be picked at the right stage for the variety, and after being allowed to cool down overnight placed straight into cool store. Delayed storage is satisfactory only as regards the Granny Smith and is fairly satisfactory for the Tasma, although the latter will hold longer if put straight into the store after picking.

PEARS.

Williams'.—Stores well for one or two months, but is risky beyond that time.

Packham's.—One of the best storers, but should have a tinge of yellow before picking, and should go straight into the store.

Winter Cole.—One of the best storers, but should go straight into the store from the tree if intended to hold for long.

Josephine.—Ripen quickly when they start and consequently should be closely watched. A very good storer.

Winter Nelis.—Very good storer.

Howell.—Liable to skin blackening on removal.

Beurre de Capioumont.—Hardly worth holding.

Beurre Bosc.—Holds well for short storings.

Glou Morceau.—A tender skin variety, holds well, liable to blackening or marking after removal from store.

PLUMS.

Although the time for picking plums is not so important as in the case of peaches, they should not be picked too early. A slightly acid taste seems best to define this condition. President is the most satisfactory storer, while Grand Duke and Pond's, and in fact most European plums, will hold well for short storage—three or four weeks.

PEACHES.

Picking at the correct time is a most important factor. Some varieties of peaches are characterised by a definite ridge, which is the first portion to become soft at ripening. Such a variety should be picked about a day prior to softening, which stage should be judged by the eye and not tested by pressure.

HISTORY OF SUGAR.

In an address before a Sydney popular science club, Mr. P. H. Goldfinch, general manager of the Colonial Sugar Refining Company, traced the history of sugar from the year 337 B.C., when the soldiers of Alexander the Great in India found the natives chewing sugar-cane, which they called "the honey-bearing root."

The earliest evidence of sugar being consumed in solid form, said Mr. Goldfinch, was found in Persia in the year 627 of the Christian era. It was introduced into Egypt and from there crossed the Mediterranean, and spread along the coastal areas as far as Spain. Up to about the year 1400 the juice was squeezed out of the sugar-cane by hand, and was concentrated by being dried in the sun. The Venetians, however, developed a process of refining the crude and sticky mass, and they turned out quite a respectable crystal sugar. They kept the process a close secret, but eventually gave it away. The people of Great Britain developed a taste for this new and pleasant form of food. After purchasing crude sugar from foreign countries they refined it in England for consumption for those who could afford to buy it. In 1688 fifty small sugar refineries were operating in Great Britain. The method of manufacture was very haphazard, and continued to be comparatively primitive until sixty years ago. At that time 14 tons of cane was required to make a ton of crystal sugar, whereas to-day, 1 ton of superior sugar is made from 7 tons of Australian-grown cane.

Mr. Goldfinch said that in 1817 Thomas Scott attempted unsuccessfully to establish canegrowing on the Hastings River. No further attempt was made to produce sugar commercially in Australia until about 1852, when Captain Hope made the first sugar from Australian cane grown in Brisbane, and manufactured in a hand mill. In 1877 there were sixty-eight small sugar-mills in Queensland, mostly horse-driven, and thirty mills on the Clarence River in New South Wales. Not one of them was in existence to-day, their places having been taken by thirty-seven large, powerful, and up-to-date mills which produced about one hundred times as much sugar as the whole ninety-eight mills did formerly.

The people of Australia consumed about 320,000 tons of sugar a year, said Mr. Goldfinch. It was all produced in Australia—about 96 per cent. in Queensland. Australia made from 500,000 to 550,000 tons a year, and the surplus was sold to Great Britain and Canada.

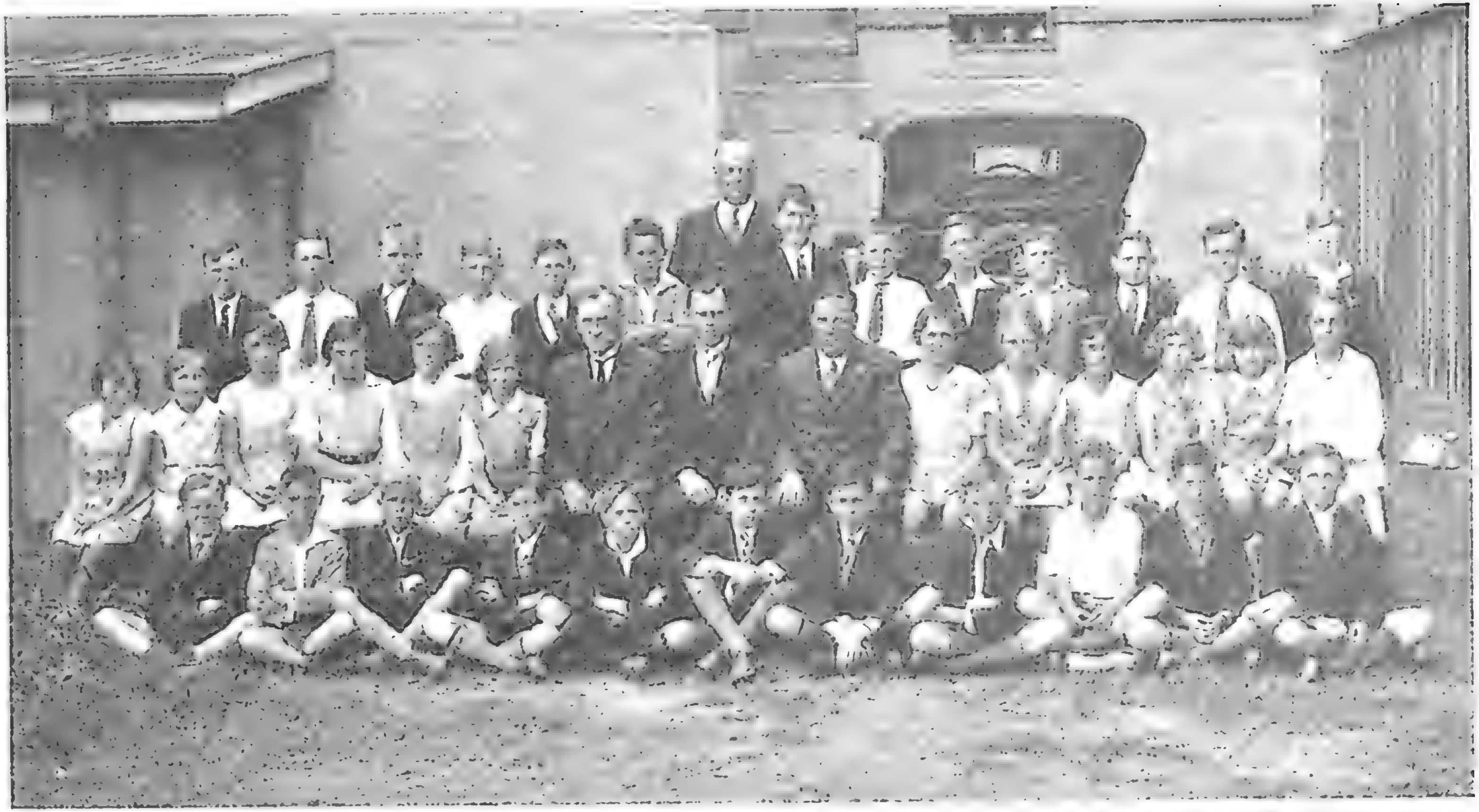

PLATE 104.

MORNINGSIDE (BRISBANE) STATE SCHOOL PROJECT CLUB,

on a visit to the Department of Agriculture and Stock. Standing in the rear is Mr. Robt. Wilson, Assistant Under Secretary, and seated in the centre (left to right) are Messrs. Rumball (Poultry Expert), Krause (Teacher in Charge), and Reid (Editor of Publications).

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Jersey Cattle Society, the Australian Illawarra Shorthorn Society, and the Guernsey Cattle Society; production charts for which were compiled for the month of January, 1934 (273 days period unless otherwise stated):—

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
JERSEY.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Pineview Buttercup	J. Hunter and Sons, Borallon	7,886·05	427·17	Carnation Lad
Carnation II. of Woodlands	D. R. Hutton, Cunningham	7,029·25	380·276	Cream Sultan of Rosedale
Princess II. of Ferndale	D. R. Hutton, Cunningham	7,584·0	374·056	Janet's Palatine of Rosedale
SENIOR, 4 YEARS OLD (OVER 4½ YEARS), STANDARD 330 LB.				
Carnation's Pride of Calton	L. A. Peirce, Graceville	9,220·22	435·723	Retford Meteor
JUNIOR, 4 YEARS OLD (UNDER 4½ YEARS), STANDARD 310 LB.				
Pineview Locket	J. Hunter and Sons, Borallon	6,754·64	386·394	Oxford Buttercup's Noble
Countess III. of Woodlands	D. B. Hutton, Cunningham	7,426·98	347·48	Carnation Golden Duke
Oxford Erin (269 days)	E. Burton and Sons, Wanora	5,549·66	322·37	Oxford Renown
SENIOR, 2 YEARS OLD (OVER 2½ YEARS), STANDARD 250 LB.				
Trecarne Milk Girl III.	D. R. Hutton, Cunningham	6,636·32	370·993	Trecarne Golden King
Canary II. of Fernlea	Kittle Bros., Gleneagle	5,767·13	335·083	Norwood Noble Boy
JUNIOR, 2 YEARS OLD (UNDER 2½ YEARS), STANDARD 230 LB.				
Pineview Myrtle	J. Hunter and Sons, Borallon	4,932·85	295·856	Oxford Buttercup's Noble

AUSTRALIAN ILLAWARRA SHORTHORNS.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Redberry of Rosehill	W. Flesser, Boyland	11,965·59	440·784	Master of Oakvale
JUNIOR, 4 YEARS OLD (UNDER 4½ YEARS), STANDARD 310 LB.				
Woranga Frances II.	R. Ray, Yargullen	8,138·0	367·034	Young Charmer of Newholme
JUNIOR, 3 YEARS OLD (UNDER 3½ YEARS), STANDARD 270 LB.				
Cinderella of Oakvale	B. O'Connor, Colinton	9,876·7	432·129	Kitchener 2nd of Burradale
Beauty of Oakvale	B. O'Connor, Colinton	9,048·35	367·022	Kitchener 2nd of Burradale
Rosehill Gentle II.	W. Flesser, Boyland	7,592·82	274·73	Phinquil of Oakvale
GUERNSEY.				
JUNIOR, 3 YEARS OLD (UNDER 3½ YEARS), STANDARD 270 LB.				
Moonji Dodo Perfection	W. R. Smee, Peeramon	5,857·75	323·111	Caramara Favour

Answers to Correspondents.

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. Cyril T. White, F.L.S.

Derris trifoliata.

I.B. (Townsville).

Derris trifoliata is fairly common in North Queensland from about Mackay northwards. It is a scrub or rain forest climber, and the stems are used by the natives as a fish poison. It bears three to five leaflets and sprays of pea-shaped flowers. If you think you see it in the local scrubs at any time you could forward specimens for identification. *Derris trifoliata,* so far as we know, is not a marketable product and nobody is collecting it. We believe the only species at present collected commercially is *Derris elliptica,* the Tuba Root of Malay, and Singapore is the chief port of export.

Blue Panic Grass.

J.W. (Guluguba)—

The Blue Panic Grass, *Panicum antidotale,* does not, so far as we know, contain any prussic-acid-yielding glucoside at any stage of its growth, and is not known to be poisonous or harmful in any way. The feed value, we should say, is unquestionably high, and the grass, though somewhat cany in nature, has one good feature: that is, it sends out tufts of leaves all up the stem, and these tufts provide young, nutritious feed.

The important point in pasture management nowadays is to have young, short, succulent grass, but, as you know, in the West this is almost impossible, because you would have short grass at one time and no grass at another. A certain quantity of standing feed is essential.

We have read of your experiments with grasses with great interest. Among those you are trying, have you tried *Phalaris tuberosa.* This makes a wonderful winter feed and should be sown in the autumn, but stock have to be kept off it until it is established.

Coastal Button Grass.

J.A.O'S. (Carruchan)—

The specimen is the Coastal Button Grass, *Dactyloctenium ægyptium,* a grass very widely spread over the warmer regions of the world. It has been established in North Queensland for a number of years past, and of late years seems to be on the increase. We have not had much experience with this grass as a fodder, but reports so far received seem to indicate that it is palatable and nutritious. The grass grows well during the summer months and dies out on the approach of the colder weather.

Sword Bean and Jack Bean.

G.H.B. (Bouldercombe)—

Your specimen is the Sword Bean, *Canavalia gladiata,* the common tropical bean cultivated to a limited extent in Queensland. The bean should be used with caution, as it does not apparently suit all stomachs, but we know of many cases of people who have used the young pods sliced in the same way as French Beans and who have said they were excellent. A far better variety is *Canavalia ensiformis,* the Jack Bean. This bean we have cultivated ourselves and used the young pods in the same way as French Beans, and the nearly ripe seeds in the same way as Lima Beans. We are sending you a few seeds under separate cover, in case you may like to try this variety.

Good Fodder Grass *(Leptochloa decipiens.)*

E.R.W. (Inglewood)—

The specimen is *Leptochloa decipiens,* a grass with a fairly wide distribution in Queensland, but nowhere, we should say, very abundant. It seems to favour rather sheltered positions, such as on the edge of brigalow scrubs, &c. It is quite a good fodder and seems to be readily eaten by stock. It possesses in rather a faint degree a prussic-acid-yielding glucoside, but apparently not in sufficient quantities to cause any trouble.

Broad-leaved Carpet Grass.

H. (Maryborough)—

The specimen is *Axonopus compressus*, the Broad-leaved Carpet Grass, a native of the Southern United States and tropical America, now naturalised in most tropical and sub-tropical countries. It has been established in Queensland for a great number of years, but only comparatively recently has it become common in the more southern parts of the State. The grass probably has value for dairying purposes on second-class country, particularly near the coast, but is not to be favoured where better grasses, such as Paspalum, Rhodes grass, &c., can be grown. A great deal of controversy has centred around this grass of late years, and in two parts of the State requests have been made to investigate its spread into the Paspalum pastures, the claim being that, in closely-grazed pastures, when it makes its appearance it dominates the pasture, making it, in comparison, almost useless. In America the grass is spoken quite highly of, and pastures of it are laid down, but the general experience in Queensland is that, though it may have value on second-class country, there is a danger it will invade and dominate first-class country to the exclusion of Paspalums, clovers, and better class pasture grasses and herbage generally.

Japanese Clover.

G.W.C. (Gympie)—

The specimen is *Lespedeza striata*, Japanese Clover. This, and other species of *Lespedeza*, have attracted considerable notice as fodders of recent years. Have you any idea how the present plant came to be on your property? Though supposed to be of only recent introduction, we have received specimens of this particular plant this year from Caboolture, and it is reported to be growing wild there. Reports from abroad seem to speak highly of the plant, but in Queensland as yet we have had no actual experience with it as a fodder. It is a legume, however, and should be quite nutritious and a valuable introduction to the pasture. Your specimen bore no seeds or flowers, and later on we would like further specimens to verify the determination.

Cultivation of Mitchell and Flinders Grasses.

J.C. (Fernlees, C.Q.)—

We have visited the property of Dr. Hirschfeld at Bybera, near Inglewood. He has made a great success of the cultivation of Flinders grass and Mitchell grass. An acre of Flinders grass on ploughed land is a picture. It shows that this grass can be grown over a much wider range than is generally supposed.

Creeping Saltbrush.

H.H. (Gladfield)—

The specimen is *Atriplex semibaccata*, commonly known as Salt Weed or Creeping Salt Bush. It is fairly common on some parts of the Downs, particularly on the western Downs, and is generally regarded as quite good fodder for stock. Stock often do not take to these Salt Bushes when other feed is available, though sometimes they will acquire a liking for them and keep them well cropped down, even though other feed is available. They often prefer them somewhat when they are drying off to when they are growing in a very luxuriant state.

Townsville Lucerne.

H.C.H. (El Arish)—

The specimen is *Stylosanthes mucronata*, the Townsville lucerne. This plant has been naturalised in North Queensland for many years, and its introduction in many places has no doubt considerably increased the carrying capacity of the pasture. We do not think there is much fear of its becoming a weed in the canefields, as it is growing in many cane areas and no trouble has been experienced from it so far. It is a legume, and ploughed in should make quite good green manure. It is also, we should say, fairly easy of eradication. It grows during the summer months, seeding and dying off on the approach of the colder weather, say, about April or early March. The plant is relished by stock when it is drying off somewhat—in fact, they often seem rather to reject it when very green and luxuriant.

White Root.

B.D. (Murgon)—

The specimen is *Lobelia purpurescens,* the White Root, a native plant that sometimes becomes a serious weed in cultivation. It is one of the most pernicious weeds we have, and the most difficult to eradicate. The only means of eradication that we know is to keep on regularly checking the green growth above the ground, so that the underground parts must eventually become exhausted by rapidly sending up fresh shoots and getting no nourishment in return. When the roots are dug up, care should be taken that they are gathered together and destroyed, for every little piece that falls or is broken and remains in the ground makes a new plant. Sprays, as a general rule, are not very satisfactory when applied to these plants, and in any case they are rather difficult to spray in garden beds where other plants are present. If the bed is vacant, you could spray with a weak weedicide, such as a weak arsenical solution. If there is any objection to using a poisonous spray, you could dig the plants up and spray the exposed roots and any green parts with, say, a solution of common salt, or with kerosene. Salt must be applied in dry weather to be effective. If the roots are sprayed with kerosene and then burnt this is a great aid.

Honey Locust.

J. O'N. (Gayndah)—

The specimen forwarded is *Gleditschia triacanthos,* the Honey Locust, a native of North America. The pods are said to have some reputation as a fodder. We have no experience of the effect of the foliage on milk and cream, but should not think it would taint them any more than a lot of other green fodders, such as lucerne, &c. The plant is not known to be poisonous or harmful in any way. In Queensland it is mostly planted in the cooler parts of the State, particularly on the Darling Downs. It is deciduous, and, like some other legumes, is rather subject to borer attack.

African Box Thorn.

THE SHIRE CLERK (Cloncurry)—

So far as we know, *Lycium afrum,* the African Box Thorn, is not growing in your shire. As far as Queensland is concerned, the only places where we have seen it as a pest are a few places on the Darling Downs and in the Maranoa district. We think it was at the instigation of some of the people in the latter district that the plant has been declared a noxious weed throughout the State. It has spread very much in some of the Southern States, particularly in South Australia, and fears are entertained regarding its spread in parts of Queensland. At the present time, we have no leaflet dealing with it, but the following description may help you:—It is an upright growing shrub, 4 to 6 ft. high, the branchlets ending in stout, strong spines. The leaves are small, rather thick, and slightly fleshy. The flowers are cup or bell shaped, and white, veined with violet. The fruit is a bright red round berry, containing numerous small seeds. It is half an inch or nearly half an inch in diameter.

A Poisonous Plant.

H.M. (Red Hill)—

The specimen is *Euphorbia tirucalli,* a native of northern Africa and western Asia. The milky sap of the plant is an intense irritant, is poisonous, and it is very dangerous to have the plant growing where there are children. If the sap gets into the eyes it causes intense pain and temporary blindness.

Pigeon Grass.

C.H.H. (Kingaroy)—

The specimen is *Setaria glauca,* a grass very widely spread over many of the warmer regions of the world, and commonly known as Pigeon Grass. It is quite abundant in parts of Queensland, mostly growing either in damp situations or as a weed of cultivation. It is quite a good fodder and belongs to the same genus as such well-known cultivated fodders as Hungarian Millet, Panicum, &c.

Florida Beggar Weed.

H.T.P. (Tulagi, British Solomon Islands Protectorate)—

As far as can be told from the single specimen, we think the plant is *Desmodium tortuosum*, the Florida Beggar Weed. It is asked if there is any difference between *Desmodium triflorum* and *Desmodium trifolium*, but we cannot trace the latter name in any literature at our disposal. The plant does not belong to *Desmodium triflorum*, but to *Desmodium tortuosum*, as stated before. The plant is a legume. It has considerable reputation as a cover crop for enriching the soil, and as a cattle fodder. It grows to a great height under cultivation, but soon deteriorates into a very poor weedy plant, especially on poorer soils. I think the plant is worth growing as a cover crop and a cattle fodder in the Solomon Islands, but its value can only be told by experiment. Florida Beggar Weed is much cultivated as a fodder crop and green manure in many tropical and sub-tropical countries. It is grown to a very limited extent in Australia.

Dysphania myriocephala.

W.R. (Warra)—

The weed is *Dysphania myriocephala*, and is very common in many parts of Queensland, though we have not heard a common name applied to it. The plant is decidedly poisonous, containing a prussic-acid-yielding glucoside. It would be particularly fatal to travelling stock which came on to it fairly hungry, for they would naturally eat it in large quantities.

Beautiful Tree for Street Planting (*Barklya syringifolia*).

H.P.J. (Wooroolin)—

The tree, *Barklya syringifolia*, would make a very beautiful street tree for planting in the Kingaroy district. It is an evergreen. We should think it would be frost tender in its younger stages. A well-grown tree would be about 25 to 30 ft. high. About 30 ft. apart would be a good distance to plant the trees. So far as our experience goes, this tree is of rather slow growth in its younger stages.

Crowfoot Grass.

T.T. (Birkdale)—

The specimen is *Eleusine indica*, Crowfoot Grass, fairly common in Queensland, but widely spread over the warmer regions of the world. It is essentially a weed of cultivation and waste places, and comes up on farms and cultivation headlands, around cow yards, &c.—in fact, anywhere where the ground has been disturbed or made bare. It is eaten by stock, but we would not say it was of much value as a pasture grass. Like members of the Sorghum family, it contains a prussic-acid-yielding glucoside, though we cannot say that any deaths caused by it have come under our notice in Queensland.

Immature Crops Bad for Pigs.

A.T. (Toowoomba)—

With reference to feeding of store pigs on young saccaline, the Agricultural Chemist, Mr. E. H. Gurney, advises:—"In young stages of growth of the saccaline variety of sorghum, it usually has a high prussic acid content. As a second checked growth is likely to occur when grazed by pigs, it is considered this practice would be attended with danger."

The Senior Instructor in Pig Raising, Mr. E. H. Shelton, advises:—"Our own experience is that it is unwise and unprofitable to allow pigs of any description to graze on immature crops, especially where there is a danger of poisoning. In the case of saccaline, it is the thick juicy stalks that have maximum feeding value, the crop being grown for that purpose and not for the leaf growth, as in the case of wheat, oats, and barley, where they are grown for use in the leafy form and not as grain. We have also had reports of danger attending the feeding off of second-growth corn stalks—that is, the young shoots that spring up when corn stalks are cut for silage-making. However, pigs are fairly immune to poisoning of the description referred to, as they do not usually eat a sufficient quantity at any one time. In this sense they are unlike cattle, which eat a very large quantity in comparison and then lie down and chew the cud. It does not pay to take risks, so our advice is to keep the pigs off the young saccaline until it comes into head. After that, it can be fed with safety as portion of the daily ration."

CROWN LAND FOR GRAZING SELECTION.

CASSILIS RESUMPTION.

Appıoval has been given for the opening for Grazing Homestead Selection of Cassilis Resumption, containig 33,600 acres, at the Land Office, Richmond, on Thursday, 12th April, at 11 a.m.

The area is situated on the eastern boundary of the holding, about 40 miles south of Richmond.

Term of lease will be twenty-eight years, and the rental 2d. per acre for the first seven years of the term.

The block is all high, open, undulating, brown-soil downs, well grassed in normal seasons, with Mitchell, Flinders, and other grasses.

Water supply consists of one sub-artesian bore, equipped with windmill, tanks, and troughing.

Other improvements on the block consist of fencing.

The selection will be subject to a condition requiring the maintenance of the existing rabbit netting fencing, and will require to be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years.

Proof must be furnished of the financial standing and pastoral or land experience of the applicants.

Free lithographs and full particulars may be obtained from the Land Agents, Hughenden and Richmond, the Land Settlement Inquiry Office, Brisbane, and the Government Intelligence and Tourist Bureau, Sydney.

BURENDA RESUMPTION.

Approval has been given for the opening for Grazing Homestead Selection of a subdivision of Burenda Resumption, containing about 23,000 acres, at the Land Office, Charleville, on Tuesday, 27th March, 1934.

The block is situated north-easterly from Augathella, about 72 miles from Charleville.

The term of lease will be twenty-eight years, and the rent will be 3d. per acre for the first seven years of the term.

The selection will be subject to the maintenance of the existing rabbit and dog-netting fencing, and will require to be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years.

Proof must be furnished of the financial standing and pastoral or land experience of the applicants.

The portion is first-class sheep country, comprising principally all high, undulating black and brown soil plains, nicely shaded, and heavily coated with nutritious grasses and herbage. The whole area is fattening and good breeding country, and is watered from natural and artificial supplies, including an artesian bore. Other improvements are fencing and dams.

Free lithographs and full particulars may be obtained from the Land Agent, Charleville, the Land Settlement Inquiry Office, Brisbane, and the Government Intelligence and Tourist Bureau, Sydney.

General Notes.

Staff Changes and Appointments.

Mr. G. S. C. Birkbeck, Slaughtering Inspector, will be transferred from Gympie to Toowoomba, and Mr. J. R. Canty, Slaughtering Inspector, from Toowomba to Innisfail.

Mr. A. F. Moodie (Inspector of Stock, Julia Creek) and Mr. R. W. Bambrick (Inspector of Stock, Toowoomba) have been appointed also Inspectors under the Brands Acts.

Captain Arthur Broadbent, of the Bowden Pearling Company, Thursday Island, has been appointed an Honorary Ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Messrs. C. A. B. Kenyon, E. P. Foster, and B. H. Halliday, New South Wales Plants Diseases Inspectors, who are stationed near the Border, have been appointed Honorary Inspectors under the Queensland Diseases in Plants Acts.

Mr. G. R. Patten, Analyst in the Agricultural Chemical Laboratory, has been appointed to the position of Senior Analyst in that laboratory.

Mr. T. L. Edwards, of Lake Pleasant, Goovigen, has been appointed an Honorary Ranger under the Animals and Birds Acts.

Mr. F. E. Hockings, of Thursday Island, has been appointed an Honorary Ranger under the Animals and Birds Acts and the Native Plants Protection Act, and Mr. H. N. Hockings, of Thursday Island, has been appointed an Honorary Ranger under the Native Plants Protection Act.

Messrs. F. B. Coleman, R. A. Taylor, and F. F. Coleman, Officers of the Seeds, Stock Foods, Fertilizers, and Pest Destroyers Acts Branch of this Department, have been appointed also Inspectors under "*The Veterinary Medicines Act of* 1933."

Mr. J. R. Canty, Inspector of Slaughter-houses, Innisfail, has been appointed also an Inspector of Stock.

Mr. J. W. Winlaw, Inspector of Stock, Dairies, and Slaughter-houses, has been transferred from Zillmere to Gladstone.

Mr. D. C. Pryce, of Toogoolawah, has been appointed Chairman of the Queensland Cotton Board until the 31st December, 1935.

Pools—An Important Principle Reaffirmed.

The Minister for Agriculture and Stock, Mr. F. W. Bulcock, announced recently that he was in receipt of communications from chambers of commerce and wheatgrowers relative to the action that had been taken in extending the date for lodgment of a petition for a ballot in respect of the continuance or otherwise of the operations of the pooling system as applied to wheat. It is the case that an extension of time for a further fourteen days for the presentation of a petition to be signed by 500 wheatgrowers was asked for and granted. It was realised by him that the prevalence of rain on the Downs preceding the original date for presentation of a petition had added to the difficulty of obtaining the requisite number of signatures of growers demanding a ballot. The principal reason for his decision, however, rested in the fact that it had ever been the policy of the Labour Government since the inception of the pooling system, to allow the majority of growers an opportunity to decide whether or not they desired to adopt the pooling system in respect of their particular industry, and on no occasion had the Labour Government attempted to impose the pooling system of marketing upon the growers of a primary product.

This principle, he contended, was major in comparison to the issue that had been raised by the various bodies, and it was one that should be rigidly maintained, even should its observance be found adverse to some other minor interest of those concerned. The necessary action to extend the life of the Pool had been taken in accordance with the provisions contained in "*The Wheat Pools Act of* 1920 *to* 1930," and the guidance of the Crown Law Department had been obtained where necessary. In the interests of the pooling system generally, it was necessary that every facility should be afforded to the growers of the commodity to indicate their desire to have a Pool extended or otherwise, and it was difficult to conceive that the interests of growers would be disadvantaged to any material degree while this principle was applied. The operations of the former Pool extended until such time as the wheat harvested in the 1932-33 season had been disposed of, and it was somewhat significant to note that no request for the extension of the Pool was lodged by the Wheat Board during 1933.

Public Service—Its Zeal and Integrity.

Following is a reprint of a leading article in "The Courier-Mail," Brisbane's morning daily, of 12th February, 1934:—

The Government's decision to reappoint Mr. J. D. Story as Public Service Commissioner for a further term of three years should be welcomed by every one who knows anything of the services that Mr. Story has rendered to the State of Queensland. Mr. Story will reach the age of sixty-five years in August next, but under the Public Service Act he may be reappointed by the Governor in Council until he reaches the age of seventy. His long career in the Department of Public Instruction has caused some people to regard him as purely an educationist, but he has given to successive Governments sound constructive advice on various other subjects with which he is well acquainted, and his annual reports have contained valuable comment on matters affecting the progress of the community. It was as a result of a visit that Mr. Story paid to America that the State's commodity pool legislation was introduced, and whatever individual opinion may be with respect to the wisdom of such legislation there will be no division of opinion about Mr. Story's activity and zeal on behalf of the State. It is a good thing for a community when its public service includes officers of Mr. Story's type. They are indeed the officers who have made the British Civil Service in all countries the fine thing it is. The civil service (or public service) is the foundaton upon which Parliamentary government rests; and, in the main, the officials are imbued with the highest traditions of conduct and of honour, and are animated with a high spirit of responsibility and of duty. No matter what political party is in power, Ministers know that the advice tendered by the permanent heads in the Government departments is the result of long experience and an earnest desire for the prosperity of the country.

Queensland is remarkably fortunate in its public service. It includes men who might easily have been more prosperous if they had given their attention to commerce or practised a profession. If the general work of the Queensland public service be considered dispassionately the observer will note, first of all, that the great machine runs smoothly, and that that part of the public which has to do with Government departments usually has very little cause for complaint. There must be a certain amount of routine in Government departments, and it is this routine which sometimes causes complaints. There may be an inclination on the part of some public servants to be a little too strict in the readings of Acts of Parliament, and that also causes discontent. But, taken generally, the public service of Queensland is actuated by a desire to help the community, and does render it very valuable aid.

The blue ribbons of the public service cannot be for every civil servant. Some attempt has been made to open wider the avenues to those ribbons by what is known as the age-limit rule; but, however popular this may be, the community in many cases would suffer if all public servants were compelled to retire at the age of sixty-five years. The experience which some civil servants gain is of great value to the State. Some work cannot be performed at all without a long experience; and it seems to be unreasonable that just when a man is really at his best he should be compelled to retire. It is pleasing to note that the record of many an officer in the Queensland public service shows that there is both zeal and efficiency in the service. There is also a great pride in the service on the part of those within it, and when the variety of duties which public servants are called upon to perform for the community is considered there can be no doubt of the ability displayed. Fears have been expressed that there has been a weakening of loyalty because of the regulation allowing public servants to take a more active part in politics than formerly they were; but while that possibly applies to a few it must be admitted that the great majority of officials give equally loyal service to whatever Government is in power.

The Dairy Products Stabilisation Act.

By Proclamation issued under the Dairy Products Stabilisation Act, the 8th February, 1934, was appointed the day for that Act to be brought into operation. An Order in Council made under the same Act provides that the members of the Butter Board and two members of the Cheese Board shall constitute the Dairy Products Stabilisation Board for a period of one year from the 8th February, 1934. The present members of the Butter Board are Messrs. W. J. Sloan (Malanda), R. M. Hill (Bororen), J. McRobert (Maryborough), J. Purcell (Toowoomba), T. F. Plunkett, M.L.A. (Beaudesert), A. G. Muller (Fassifern Valley, Kalbar), and E. Graham (Director of Marketing). The two members of the Cheese Board appointed to the Board are Messrs. H. T. Anderson (Biddeston) and A. J. Harvey (Pittsworth).

"The Veterinary Medicines Act of 1933."

The Veterinary Medicines Act came into force on 8th February. Regulations to give effect to the provisions of the Act have received the approval of the Executive Council, and a Veterinary Medicines Board, consisting of Messrs. E. H. Gurney (Agricultural Chemist), A. H. Cory (Chief Inspector of Stock), St. G. Thorn (Bacteriologist), and J. A. Rudd (Director of the Animal Health Station and Government Veterinary Surgeon) has been constituted. Mr. W. G. McKechnie (Analyst in the Department of Agriculture and Stock) has also been appointed Analyst under the Veterinary Medicines Act.

Annual Carcass Competition—Export Porkers—Special Conditions.

Attention is drawn to the holding of annual carcass competitions by the Queensland Meat Industry Board, the first of which is to be held on the 31st May, 1934, at the Brisbane Abattoir. These competitions provide for beef, lamb, and pork carcasses suitable for the export trade, and should attract considerable attention and be productive of much good to live stock interests in this State.

In class "C" provision is made for six carcasses of pork, dressed weight 60 to 80 lb., first prize £15, second prize £10, and third prize £5. Entries must be made in respect of ten pigs and must be on the form provided for that purpose by the Queensland Meat Industry Board, and must be lodged not less than fourteen days before date on which the competition will be held. A separate entry must be lodged with each exhibit, each exhibitor being allowed no more than two entries. There will be no charge for lodgment of entries.

From each exhibit of ten pigs there will be selected the best six carcasses for the purpose of the competition. If any person lodges two entries in any one class, the animals comprised in each entry must be so marked as to be easily distinguishable from the animals in the other entry. All such marks must be shown on entry form.

All pigs exhibited must be bred and fattened in Queensland, and must have been the bona fide property of the exhibitor for the three calendar months prior to date of lodging the entry. All pigs exhibited must be consigned to the owner's selling brokers and placed by them in their allotted pens at the saleyards, Cannon Hill, and sold by public auction on Monday, 28th May, 1934. All pigs will be exhibited at owner's risk, and while in the saleyards will be subject to the usual saleyards conditions. Each exhibit shall be offered for sale as one lot, and the splitting of any exhibit between purchasers shall not be allowed.

Pigs exhibited will be taken delivery of by the Queensland Meat Industry Board immediately after sale, and on no account will any animal be removed from the Board's pig pens. All pigs exhibited will be slaughtered and dressed on Wednesday, 30th May, 1934, and card showing the dressed weight will be placed on each carcass. The Board reserves the right to cut any exhibit of pork into such portions as it so desires, and will be prepared to purchase at the original purchase price any carcass which has been so cut. The pork exhibited shall be delivered to the purchasers of the live stock on the morning of Friday, 1st June, 1934.

In the pork competition the judge must reject any carcass which is below the stipulated minimum weight, but may allow in the exhibit any carcass over the stipulated maximum weight, provided that the average of the six carcasses in the exhibit does not exceed the stipulated maximum weight. The judges shall not award any prize unless they deem the exhibit for such prize to have sufficient merit. A standard scale of points has been decided upon, and a copy of the completed scale will be sent to each exhibitor, who will thus be able to detect his faults by the number of marks in relation to the maximum.

Any further information required may be obtained from the Secretary, Queensland Meat Industry Board, Cannon Hill, Queensland.

Prohibition of Removal of Sugar-cane Plants from Kalkie District.

A Proclamation, made in pursuance of the provisions of "*The Diseases in Plants Acts,* 1929 *to* 1930," prohibiting the removal of sugar-cane plants, for any purpose other than to be milled at Millaquin sugar mill, from the quarantine area embraced in that portion of the Kalkie district described below, has received Executive approval. This quarantine area has been declared owing to the prevalence of Fiji disease of sugar-cane, and it may be described as being the area of land bounded by the Back Ashfield road on the south, the Ashfield road, and thence a line drawn in continuation to the Burnett River on the east, the Burnett River on the north, and the boundary of the city of Bundaberg on the west. The removal of sugar-cane plants from this area is prohibited, unless a permit in writing shall have been first granted by an inspector in the prescribed form.

Rural Topics.

Maize versus Sorghum as Silage.

Saccaline sorghum has become very popular with dairy farmers as a silage crop; so much so, in fact, that several delegates to the recent Upper North Coast (New South Wales) Agricultural Bureau Conference expressed surprise that maize should be considered by anyone as being superior to saccaline for silage making. Officers of the Department of Agriculture of New South Wales, however, have always claimed that maize is a better silage crop than sorghum, being less subject to disease and producing fodder of higher feeding quality.

In the coastal fodder conservation championships of past years, practically every competitor has favoured maize silage. Commenting on this point the Chief Instructor of Agriculture (New South Wales), who judges these championship competitions, explained that maize excels all other fodder crops in the total nutrients produced per acre. On the poorer soils, however, sorghum yielded better than maize.

Writing on the subject of suitable silage crops, the Senior Agricultural Instructor stationed on the North Coast (New South Wales) says: "Maize makes the best silage. It is bulky, produces a heavy tonnage per acre, and retains its moisture well. Generally speaking, it is at its best stage for cutting when the grains cut like cheese, which is approximately three weeks later than the roaster stage. It has been found, however, that sappy stalks lend themselves better to packing and compressing in a trench silo (very dry and pithy stalks should always be avoided); and it is therefore not always advisable to wait for the grain to become cheesy. In this connection some discretion should be used.

"It sometimes happens that farmers' crops are of different ages—one patch ready for silage and the other immature. It is preferable to allow the latter to mature nearly to the correct stage, provided, of course, the earlier crop does not lose too much of its succulence. The ripest maize should be pitted first. Good maize silage should have a fairly high percentage of cobs scattered through it.

"Sorghum, cut between the flowering and firm seed stages, has become a very popular crop for silage. Because of its drought-resistant capacity it does well on second-class soils."

Crutching of Sheep.

Crutching usually takes place about midway between shearings, and is therefore considered to be of some value as a preventive of blowfly infestation, as the fly does not operate so freely when the wool is short. With ewes in lamb crutching is usually performed about six weeks before lambing, the object being to clear away all wool from the hindquarters and over the udder, so that at lambing time there will be less attraction for the blowfly, and in order to make it easier for the young lamb when suckling its mother.

Maiden ewes and ewe weaners also require careful crutching, and the whole ewe portion of the flock is usually crutched at the one time. The crutching of ewes should extend well above the tail, taking in all the inner britch and, as stated above, in the case of lambing ewes, the area close to the udder.

Unless the fly is particularly bad, the only time it is necessary to crutch the wethers is when, owing to change of feed or other causes, they become scoured, in which case the soiled wool should be removed. When crutching wethers, therefore, only the wool immediately below the tail will be removed, apart from the usual "ringing."

All sheep which are heavily woolled on the head should at this time be wigged. If this is neglected, such sheep become wool-blind, and, being unable to find their way to the water, fall away in condition and sometimes die. There is greater danger also of grass-seed entering the eye when a sheep is very woolly on the face.

Some sheepowners do not consider crutching necessary, but because of the cleaner appearance of the sheep and the absence of trouble with daggy wool at shearing, the operation is recommended, even though the fly may not be active.—A. and P. Notes, New South Wales Department of Agriculture.

Better Export Lambs—Competitions among Breeders.

Not more than 25 per cent. of the lambs sold at Homebush saleyards are the ideal export type. Such a state of affairs makes it difficult for this State to compete overseas in the fat-lamb trade. With the idea of bringing before fat-lamb breeders their shortcomings and of affording them an opportunity to learn how best to improve their methods, Export-Lamb Breeders' Competitions were inaugurated last season. These, taken in conjunction with the Royal Agricultural Society's Export Lamb Carcass Competition, should do much to raise the present standard of our export lambs.

Practically every export lamb-producing district in the State was represented in the competition, and almost every breed at all popular in New South Wales for lamb production was entered. Local competitions were held in most districts, and many of the benefits of these competitions are gained by breeders accompanying the judges during their inspections of the different flocks, when the defects of the animals are pointed out and suggestions offered for their improvement.

Generally speaking, the standard of the lambs exhibited was very good. The first eight teams were particularly good, and in the opinion of the judge (the Senior Sheep and Wool Instructor of the Department of Agriculture) they indicated that our breeders can, with correct methods, produce lambs equal to any in the world. The objective of all other breeders should be to attain as high a standard as the most successful exhibitors in the competition. A comparison of monetary returns would readily prove that any added work and expense along these lines would pay handsomely.

The winning entry was that of Mr. H. S. Henley, "Basset Downs," Cowra, Mr. W. McSweeney, "The Rivers," Canowindra, and Mr. B. J. Stocks, "Linden Hills," Cunningar, occupying second and third places respectively.—A. and P. Notes, N.S.W. Dept. of Agric.

Destruction of Summer Weeds.

The most economical method of destroying summer-growing weeds is by harrowing when the weeds are at a very young stage, but owing to the protracted nature of the harvest due to frequent rains, most farmers were obliged to concentrate all available power and labour on harvesting operations when the weather was suitable, and the fallows had to be neglected. With the completion of harvesting, however, there should be no delay in cultivating fallows to destroy the weeds, for they should not be allowed to flourish any longer than can be avoided, as they are continually pumping up moisture from the soil and utilising plant food, thus nullifying the work that has already been done in fallowing the land. Furthermore, if the weeds are not destroyed without delay they will foul the land with their seeds, and if the cultivation is left till near the sowing period the undecomposed plants will prove a hindrance to the satisfactory sowing of the wheat.

The best implement for destroying a heavy growth of weeds is the disc cultivator. Under normal conditions the use of this implement has a damaging effect on the fallow by disturbing the compacted seed-bed, especially if the working is performed near the sowing period. If, however, the disc cultivation is carried out at the present time, particularly in the later districts, there is a reasonable probability, judging by the nature of the season, that sufficient rain will fall subsequently to restore the compactness of the seed-bed before sowing.

The rigid-tined cultivator, when fitted with wide shares, is also effective in destroying weeds, but in the event of rain falling shortly after the cultivation there is a greater risk of a proportion of the weeds taking root again.—A. and P. Notes, New South Wales Department of Agriculture.

A Point in Milking.

Most of the troubles in milk and cream are caused by organisms closely associated with cow manure. Milk in the udder of a healthy cow in normal condition is practically free from bacteria, but directly it is drawn from the cow by ordinary methods of milking it may contain many thousands of bacteria per cubic centimetre. The first point of infection is the teat. Cows lying down will often squeeze out a drop of milk, which becomes infected with bacteria from the ground. These work up through the teat canal and multiply rapidly.

Thus the first milk drawn from the cow generally contains large numbers of objectionable organisms, and dairymen are well advised to discard the first few squirts of milk as drawn. Practically nothing is lost in doing so, as it has been definitely proved that this first milk contains practically no butter-fat.

The Export Trade in Pig Products.

At the recent annual meeting of the North Canterbury Co-operative Sheep-Farmers' Freezing Company (New Zealand), the chairman, Mr. J. H. Blackwell, had this to say:—

The attention of producers can, with advantage, be given to developments now taking place in the pig export business. Hitherto this has been almost negligible as far as New Zealand is concerned, and for the five years ended 1932 the annual export of pork carcasses ranged from 130,000 to 150,000. The season just ended, however, shows a marked increase to 310,000, a jump of over 100 per cent. in one season.

One of the most striking features of the United Kingdom meat market was the tremendous increase in supplies of foreign bacon imports between 1929 and 1931. In two years these imports rose from 8,250,000 cwt. to over 11,000,000 cwt., or by 33⅓ per cent. This increase alone—2,750,000 cwt.—is estimated to be equivalent in weight to the whole of the lamb imported into Great Britain in 1931. This was one of the greatest factors in depressing the price of lamb, and received especial attention by our representatives at Ottawa.

Great Britain has promoted legislation to restrict foreign imports of bacon, while the Ottawa agreements contain provision for expansion of the New Zealand pig export industry. So far New Zealand has failed to secure anything more than a fraction of this vast market, but has, at any rate, shown that the Dominion can breed and fatten and export the right class of pork. In the South Island hitherto little interest has been taken in the matter of pork export, the proportion of output of 310,000 carcasses this year being:—North Island, 98½ per cent.; South Island, 1½ per cent.

To Maintain Egg Production.

In view of the low return for eggs, it is essential that the greatest care be exercised in the management of the pullets and laying stock generally in order to maintain production at the highest possible level. It is at this time of the year that the careful and skilful poultry farmer reaps the reward of his labours (writes the Assistant Poultry Expert of the Department of Agriculture in current notes). During the flush season a little lack of attention or mismanagement may not have any serious consequences, but from now till next spring no liberties can be taken without the risk of seriously affecting the egg yield.

As far as the young stock are concerned, the main essential is to prevent any crowding, particularly among the later birds, but the mistake should not be made of thinking that the early pullets can be housed in large numbers with impunity. This error, it is not fully realised, leads to much trouble. For instance, such conditions often result in the early moulting of pullets. Again, an early outbreak of chicken-pox is frequently the outcome of unduly crowding the young stock.

On farms where the accommodation does not permit of spreading out the young stock, the best course would be to reduce the second-year hens as much as possible by marketing those which appear unlikely to continue laying through the off season, or to erect some cheap temporary shelter and run to accommodate them, thus making other pens available for the new season's birds.

Correct feeding is another important factor influencing egg production, and this applies not only to the class of feed given, but also to the manner in which it is fed to the birds. The latter calls for much closer attention at this time of the year than it is often given, and a little extra time spent on this work would be amply repaid.

Too often one sees the feed hurriedly thrown to the birds, as if feeding were a task to be got through as quickly as possible. The skilful feeder does not rush operations. He puts down a certain quantity of food, and then stands by for a few moments to gauge the appetites of the birds, and if they show keenness (but not otherwise) gives more food; or he gives the feed all round and then returns to see if more is required. This method should be adopted at both the morning and evening feeding where the wet mash system is employed, the art of feeding being to give just as much as the birds will eat at each feeding time without having any food lying about. In some instances where dry mash is used a partial feed of wet mash is given during the day, and in such cases care is necessary not to feed too heavily with the wet mash, because this will result in the birds becoming surfeited, and thus bring about an unhealthy condition.

Udder Wounds and Treatment.

Such injuries to the udder of the dairy cow as those caused by blows, hornings, kicks, treads, barbed-wire cuts, &c., may not only result in an inflammatory condition of themselves, but may also serve as portals for various specific infections. It is all the more important, therefore, that the injuries should not be neglected.

All dirt and foreign matter should first be removed by careful washing of the part with a weak solution of antiseptic (2 per cent. lysol or similar disinfectant). When cleansed, surface injuries may be dusted twice daily with an astringent such as zinc and starch powder. No further washing should be carried out unless there is considerable discharge. Sometimes pus-forming organisms gain entrance to udder injuries, especially if the wounds extend beneath the skin into the udder tissue. Under suitable treatment these wounds will heal, but frequently, in spite of apparent healing, the organisms remain and later set up mammitis.

Injuries to the udders of cows in full milk are often troublesome, since the milk is constantly leaking on the wound and healing is thus retarded. In spite of any treatment that can be adopted by the farmer, such wounds frequently fail to close completely, there being left a small opening through which milk constantly leaks. This type of wound is not uncommon after injuries to the teats, and surgical measures are necessary to remedy the condition.

The general principles to be followed in the treatment of injuries which penetrate more deeply than through the skin are:—

Cleansing of the wound as soon as possible with weak antiseptic solution.

Removal of all torn shreds or loose pieces of tissue with a sharp pair of scissors, which have been boiled immediately prior to use.

Suturing of the wound with sterile (boiled) thread and needle. (This is best carried out by a veterinary surgeon.)

The protection of the wound from further infection by use of an antiseptic dusting powder applied at frequent intervals, or by the frequent application of an astringent solution, such as white lotion made up with the following:—

Sulphate of zinc, $\frac{3}{4}$ oz.
Acetate of lead, 1 oz.
Water (boiled), 1 pint.

A white deposit will form in the bottle when it is allowed to stand. The bottle must be well shaken before the liquid is used. For safety the bottle should be labelled "Poison."

If the wound shows much swelling, intense redness and discharge of pus, frequent irrigation will be necessary to keep it clean. Such irrigation should be carried out with any weak disinfectant solution, but permanganate of potash solution, peroxide of hydrogen, or hypochlorite solution are especially useful.

In all cases of udder injury the wound should be protected from flies and dust as far as possible. Hence cows should be kept in a small, clean paddock close to the dairy, and the wound covered lightly with clean gauze, kept in place with adhesive tape, or the udder covered with a suspensory bandage.

Should the wound heal but leave an opening through which the milk leaks, no attempt at treatment should be made by the farmer. The case is one that should have the attention of a qualified veterinarian.—A. and P. Notes, New South Wales Department of Agriculture.

Load Pigs on One Deck Only.

The North Queensland Co-operative Bacon Association draws attention to increased freight rates charged on pig wagons despatched from country stations to factories, and mentions a typical case as follows:—Pig growers are requested to load the bottom tier of pig wagons to maximum capacity before placing pigs on the top tier, thus utilising the whole truck instead of half truck, when number forwarded only warrants half truck. This additional care in loading enables the factory to minimise freight charges. Recently the factory ordered one tier of a pig wagon, and provision was thereby made for loading of up to twenty-five bacon pigs at a freight charge for half wagon of £1 4s. Actually, eighteen pigs only were loaded, some being placed in the top and some in the bottom tier, and this resulted in factory being charged an additional £1 4s. for freight, or £2 8s. for full wagon, whereas the number of pigs sent in was less than that required for one tier only.

It is in matters like this that farmers and trucking agents can do much to assist in reducing manufacturing costs and assisting to make the pig industry a more profitable one.

Green Manuring.

Green manuring benefits the soil in two ways. It enriches the soil, in the first place, by supplying it with a considerable amount of readily available plant-food, and in the second place, by adding humus, and thus improving the soil's texture and its power of absorbing and retaining moisture. When a manure crop is buried, the surface soil becomes enriched by the nourishing materials which the crop during the period of its growth has drawn from the air and from the lower portions of the subsoil, and this material is now placed within the reach of the succeeding crop.

During the growth of the plant the soil has, in addition, been stirred up and disintegrated by the development of the roots. When ploughed under, provided sufficient moisture and warmth are present, the buried mass decomposes with more or less rapidity.

A further important result is the formation of carbonic acid by the decomposition of the buried crop. Carbonic acid is given off abundantly in the fermentation of the mass, and assists in the disintegration of the soil and in rendering available the plant-food contained in it.

With regard to the kind of crop to be used for the purpose of green manuring, a good deal of latitude is permissible. Any crop that is rapid and luxuriant in growth, and that can be readily turned under, is suitable for the purpose, and the selection will be guided by considerations such as the time of year at which it is to be grown, its suitability to soil and district, &c. Among the most effective crops for the purpose are leguminous plants, such as clover, velvet beans, peas, &c., since these are specially valuable on account of their power of obtaining their nitrogen from the air. They are, therefore, specially suitable for soils poor in nitrogen, and are of high value in enriching the soil with this ingredient.

It is a not uncommon fallacy that if a leguminous crop is removed from the land and the roots with their nodules remain, the soil is thereby enriched in nitrogen. The nitrogen taken from the air by legumes in association with certain bacteria in the soil does not, however, exist in the nodules, but is made use of and distributed throughout the plant, and the removal of the above-ground portion of the plant from the land therefore means the removal of a large amount of nitrogen. An increase in the nitrogen content of the soil can only result from the growing of leguminous crops when they are ploughed in, or when they are fed off or soiled to stock, and the resultant manure from the stock is returned to the soil.—A. and P. Notes, New South Wales Department of Agriculture.

English Carcass Competition—Large and Middle White Pigs.

There were ninety-nine entries in the pig carcass classes at the 1933 Smithfield Meat Show, London. The judges, after very careful inspection, awarded thirty-five prizes and commended cards, and of this number no fewer than thirty-one went to carcasses of British breeds, under the control of the National Pig Breeders' Association.

In the first class—one pig above 70 lb. but not exceeding 100 lb. live weight—the Middle White secured four award cards consisting of reserve, third, and two highly commendeds. The awards to Large White and Large White crosses in this class included first and reserve for the porker championship, second (a Tamworth Large White cross), and fourth (Large White Berkshire cross). Two of the three purebred Large Whites entered were highly commended.

In the 100 to 160 lb. class, sixteen out of eighteen prizes were awarded to N.P.B.A. breeds. Four of these went to Large Whites, including first and champion porker and supreme carcass of the show, reserve, and two highly commendeds. Two Middle White entries were awarded H.C., and two Berkshire-Large White crosses were awarded second and highly commended respectively, and a Berkshire was awarded fourth.

Of the five prize cards awarded in the bacon pig class, all were to pigs of the N.P.B.A. breeds or crosses. Large Whites figures in all awards—purebreds to win the third and fourth prizes, and as the top cross in the case of the first and reserve championship, the second and the reserve exhibits.

The Large White breed, which secured the cup for the best pig carcass, previously won the supreme championship in 1928. Since that year the cup has been won once by the Berkshire breed, twice by the Large White-Middle White cross, once by the Large White-Large Black cross, and twice by purebred Large Whites.

Since 1928, when championships were introduced for the best carcasses in the two porker classes, Large White and Middle White crosses have won three times, Large White once, Berkshire once, and Middle White once.

The bacon pig championship has been won four times by the purebred Large White, once by a Tamworth-Berkshire, once by a Middle White-Large Black, and once by the Large White-Large Black cross.

Rapid Growth in Pigs.

From figures compiled recently in England relating to the average daily gain of pigs in the live stock classes at the Smithfield Show, London, it appears that the Large White breed made the highest breed gain—1.34 lb. per day, as compared with 1.12 lb., the aggregate gain of all pigs in the show. Since 1927 the championship for live pigs not exceeding five months has been won twice by Large Whites and once each by the Middle White, large White-Middle White, Middle-White-Large White, and the Essex breeds, respectively.

The championship for pigs above five months has been won five times by the purebred Large Whites and once by the Large White-Middle Whites in the past six years. The white breeds maintain their popularity in spite of keen competition of black and red breeds and of crosses of these popular types.

Agriculture in Japan—The Farmer the Burden Bearer.

In a description of Japanese life by an Australian observer (A. M. Richards, M.A.) in the "Sydney Morning Herald" of 19th February, occurs these interesting remarks:—

Contrast, however, the state of Japanese agriculture and the lot of the peasant. Japan is only the size (approximately) of New Zealand. In the mere 20 per cent. of that area in which agriculture is possible live 27,000,000 peasants. Farms range in size from about 1 acre to 3½ acres—2½ acres being the average. The Christian movement in Japan has bettered conditions enormously in some areas by its organisation of co-operatives. But they cannot radically alter the whole position, which is dependent upon the huge debt, estimated at 6,000,000,000 yen, which Japanese agriculture as a whole owes to Japanese finance. Sesumi, in his authoritative book on "Modern Japan," quotes cases where the whole rice harvest of farms has been sequestrated to pay the interest account, leaving the family to subsist on the "extras"—eggs, vegetables, &c.

Cheap food allied to simplicity of living makes possible Japan's unique combination of low industrial wages with high industrial efficiency. The peasants' hard-wrung yen swells Japanese capital (through his indebtedness to financial magnates and institutions). And he is, in the last resort, the source of revenue for national expansion, both mercantile and military.

It has always been the policy of modern Japan to foster export industries at the expense of the whole nation. Economic planning is nothing new in the land of the rising sun. While still a medieval, feudal land, the ultra-modern policy of systematic crop destruction was a recognised method of intra-national economic control. Then, when the restoration of 1868 put into control of the national destinies an Emperor and supporters determined on a complete modernisation of political and economic life within their own lifetimes, a scheme of development—a fifty years' plan as it were—was laid down for the mobilisation of the whole national resources to that end. Individual enterprise was left to fill in the outline of the plan. But when individual enterprise needed assistance to complete its own small corner it always got it. "Industrial feudalism" would well describe this system of State-initiated and (in cases of need) State-subsidised industry and commerce at its inception. To-day no great changes would be needed to transform it into full-fledged "intra-national socialism." A "laissez faire" stage Japan has never had.

During the last few years, however, Japan has found herself in a desperate economic situation. Industrialisation has naturally created a large population dependent for its very existence on the margin of profit between "raw" imports and manufactured exports. But when "American prosperity" collapsed, the silk export trade collapsed with it. China and India raised their tariffs against Japanese cotton goods. Resistance to penetration in Asia was renewed in the form of boycotts, which damaged exports and led to the expense of a considerable war. Finally, Great Britain's abandonment of the gold standard robbed Japan of some of the competitive advantages she had long enjoyed, just at a period when she was suffering from the adjustments consequent upon her own return to gold. Hence the present determination to sell at almost any price, even if it can be done only at the cost of still further suffering to the peasant.

Not low wages, therefore, nor industrial efficiency, though both count, but simplicity of life and a nationally controlled economy operating at the expense of the peasant is the secret of Japan's ability to undersell the world. Her almost desperate position in the world depression creates the necessity for doing so.

A Primary Producers' Secretary.

The attributes of a competent secretary of a primary producers' organisation are discussed in the following extract from an article in "The Producers' Review" (Toowoomba) for January:—

A primary producers' organisation must have for its objective something above mere mercenary gain. The soul and spirit of farmer-organisation should be the appreciation and realisation of the fact that all primary producers belong to one family and that their interests are mutual, and one of the chief objectives of the organisation of any particular section of primary producers should be to eventually weld together in one big union all primary producers. This being so, what, then, should be the calibre and attributes of a primary producers' organising secretary?

First of all, he must be one of themselves; in other words, he must understand their outlook on life; he must understand and sympathise with that spirit of independence in the farmer and his wife that drives them on to the selection in its virgin state with no other assets than stout hearts and strong arms and the dream of a "home of our own." He must be possessed of a dynamic force that is the driving-power of his particular section of his organisation. He must "think" but not "act" for his executive bodies—the latter is their duty.

A primary producers' secretary is in a totally different category to that of a secretary of a business firm. A mere recorder of minutes is totally unfitted as an organising secretary of a primary producers' organisation. A primary producers' organising secretary must have initiative, originality, constructive ability, and sufficient moral courage to stand for the ideals of farmers' organisation in spite of the effect it may have upon his own position.

The ideal farmers' secretary must understand that something in the makeup of the true farmer which abhors the name of master; that something which impels him to till the soil not altogether for the sordid desire of money-making, but the love to "plough and to sow, to reap and to mow," the keen interest in watching things grow, the love of producing with his own hands, the realisation that by the application of his own labour to the soil he has created something. The joy of his life has been reducing the soil to the finest tilth and planting it, realising that if nature smiles on him he will be rewarded for his labour as far as an abundant crop is concerned. But, alas! nature is not kind. Adverse seasonal conditions begin to cause heartache and disappointment. The ideal secretary must understand these joys and sorrows. They must be in his blood, otherwise he can never accomplish anything of real worth where the primary producer is concerned.

Such a secretary must feel that he is working, not merely for the purpose of holding down his job, but for the common weal. The true secretary of agricultural movements would not waste his time on the job if he were not accomplishing something; assisting to educate those whom he represents; ever aiming at a gaol, no matter how far distant its accomplishment may be. No matter how much he realises that it will not be accomplished in his time, he must fight on, with others, in blazing the track. The mere routine secretary, who is happy wound up in red tape or is content to be just a rubber stamp for those who employ him, is of no value in any producers' organisation. Those who run may read, and he is certainly dull of comprehension who does not see in the signs of the times a world-wide organisation of production and distribution. Australia—Queensland in particular—is leading the world in this particular direction with its agricultural machinery.

Throughout the world we hear the murmur of discontent from primary producers. To-day it is a small cloud on the horizon; to-morrow it will be an irresistible storm. The time has long passed when the primary producer should remain the bottom dog. But he does little or nothing principally because he has not the right men to drive him into action. These men are certainly hard to find; they are not born, but made —made through the hard school of practical experience in the first instance; made by the gift of vision and ideals. It is time that primary producers started to produce something besides commodities. They should produce organising secretaries by finding the men in the making, because they will be wanted if primary producers are ever to come into their own. Men are wanted who are not job-hunters, but men who know the potential strength of their own farming community and are prepared to devote a lifetime to developing it.

Only a Good Sow is Worth Keeping.

Seeing that it costs no more to keep a good sow than a bad one, it is obvious that a bad sow must be a money-loser all the time. The bad sow, no matter what her pedigree, is the one which does not do well for her owner, or, in other words, does not achieve what may be considered average results.

The average sow, so far as breeding capacity goes, may be considered capable of performing her duties for at least four or five years, though there are some that will remain profitable much longer than that. If a sow that has been hitherto satisfactory shows a decided falling-off after her first two or three litters, then she should be scrapped forthwith and replaced by another.

It should be borne in mind, however, that the fault sometimes lies with the boar. A change of boar will often work wonders in the herd, and this is a point that must be constantly watched. Many a sow has been blamed for producing small or weakly litters, when all the time it was not her fault at all. When a sow, which is otherwise good and has done well in the past, suddenly fails to maintain her reputation, the possibility of the boar being at fault should never be overlooked.

No sow which does not prove herself to be a good mother is worth keeping. Her performance with her first litter, however, does not necessarily prove her abilities in any direction. If she be a well-bred sow, or with such good points about her that she seems worth keeping, then she should certainly have a second chance, even though she has made a mess of her first attempt. If often happens that a maiden sow which produces a small or poor litter does very much better with her second lot, and will continue to do well subsequently. There may be many reasons why a young sow should fail in the beginning—one of them may be the attempt to breed from her too soon. In most cases it is wiser to wait until a sow is at least ten months' old before allowing her to breed.

Something must be added as to the importance of giving a sow every chance to do her best. No sow can show good results if she be improperly fed, roughly handled, badly housed, or subjected to undue interference at critical times. When failures occur, every pig-breeder should ask himself whether it is really the sow that is solely to blame, or whether there may not have been some contributory cause. In such cases, if there be any doubt, the sow should have the benefit of it; if there be no doubt at all, then the sooner she is fattened off and got rid of the better.—"The New Zealand Farmer."

Large or Small Litters?

One has heard it said before now that big litters are not altogether desirable, the argument against too great fecundity in the sow being that when there are many the pigs can never be so good as when the family consists of a more reasonable number. It is also argued that a sow which produces more pigs than she can comfortably rear, is wasting her substance to no good purpose.

But are these theories borne out in practice: If it were possible, one would, no doubt, regulate the size of the sow's litter on each occasion to the number of pigs that she was capable of rearing satisfactorily—say, eight to ten. But since we cannot do that, surely it is better that a sow should err on the side of extreme prolificacy than in the opposite direction. It is by no means certain that a sow, which produces twelve or more pigs at a time, is over-taxing her strength. If she be well fed and properly looked after she should be none the worse, though to let her try to rear more than ten would, in the majority of cases, be unwise. One hears sometimes of litters of extraordinary size—as many as eighteen or twenty. Obviously to let a sow try to rear so large a lot as that would end in disaster.

The chief advantage of large litters is that it allows a margin for those casualties which often occur. In a very large litter there were certain to be some pigs that are more or less worthless from the first. Such pigs can be sacrificed without any qualms. But even when the family is a large one it is a mistake to weed out any pig that seems to have a chance, until the danger period is over. As a general rule, this extends over the first three or four days after birth. If any pig succumbs from natural weakness or from some unnatural causes, the misfortune will probably occur within the period mentioned. After that one may use one's discretion in regard to the remainder. If there are still too many it may be advisable to scrap one or more of the worst specimens. Unfortunately, when accidents occur to small pigs soon after birth, it is often one or two of the best that are the victims, but that cannot be helped except so far as to take the usual precautions.—"The New Zealand Farmer."

When Cattle Judges Don't Agree.

Thus "Himi" in the "New Zealand Farmer":—"I can't see what he saw in that cow to place her first," said a rather celebrated breeder regarding the decision of an experienced judge at a recent show. It is curious how widely opinions differ. On the Island of Jersey it is generally the rule that a different set of judges is used for the championship awards, and this often causes a reversal of judgment. That is to say that a second, third, or even a fourth prize animal in a class may eventually win the championship. The explanation is that some judges may favour and give more points to vessels, for instance, whilst others may regard body formation or fineness of bone as a greater asset. "No udder, no cow," is generally considered sound opinion, but, of course, it is the finer points of distinction—those which determine between a nearly perfect and a perfect udder, a fine and a superfine bone, a really good body and a body that is better still—which raise the difficulties. And in assessing the value of one attribute as against another the real problem arises. The possession of a fine square bag running well under the body with beautifully placed teats, and showing no cut in the back of the bag, does not prove that the cow is a wonderful producer. This type of animal looks best when she is fresh. On the other hand a cow with a big, deep body, a straight top, pin bones placed high, good setting, with a head nicely dished and intelligent eyes, will look well the whole year through. But, as has already been suggested, it is in the nice and exact balancing of the various qualities that creates the difference of opinion so frequently observed in the show ring.

Silage—Useful Hints.

In an address on silos and silage at the recent Upper North Coast conference of the Agricultural Bureau of New South Wales, Mr. Alex. Smith, of Bandon Grove, gave a number of useful hints concerning a form of fodder conservation the advantages of which no dairy farmer can afford to overlook. With regard to the varying character of silage, it was stated that the British Ministry of Agriculture recognises four types—

(1) *Sweet Dark Brown Silage.*—Made when the material heats up too much and the temperature rises above 113 deg. Fahr. Factors contributing to this are a comparatively dry crop, either one that is dry from being mature, or from being allowed to dry somewhat after being cut. Such dry crops facilitate fermentation, both because they do not pack so tightly and thus allow air to penetrate the silo readily, and because the heat that is generated by fermentation has comparatively less moisture in the silage to heat, and, consequently, the temperature rises more.

(2) *Acid, Light-brown or Yellow-brown Silage.*—When less air is allowed to intrude than above, and the material does not heat up so much, this type commonly occurs (temperature range 86 to 104 deg. Fahr.). As a rule there is not much juice expressed from the silage when this type is being made. Acid brown silage is commonly made in pit and trench silos. This silage has a yellow-brown colour, and an acid, though pleasant, smell, largely due to the presence of acetic acid, the yellowish types having the more pleasant smell. It is readily eaten by stock, which thrive upon it, and it is to be recommended. This is the most common form made, and it is much superior to the sweet dark-brown variety.

(3) *Green "Fruity" Silage.*—Usually this quality is only made by chance, and it is hard to control conditions so as to make it with certainty. It is made by rapidly building fresh, lush, leafy grass (temperature about 86 deg. Fahr., but no higher). This type has a green to olive-green colour, and a smell that is delicious—neither sweet nor sour—and is best described as "fresh" and "fruity." It is greedily eaten by stock, and it has recently been shown that its digestibility is very high. It has one disadvantage—much juice is lost.

(4) *Sour Silage.*—Sour silage has generally a dark-brown or olive-brown colour, and a pungent and very unpleasant smell, due largely to the presence of an acid. It is commonly made when a very immature and succulent crop is ensiled. In this case the watery fodder packs down very closely in the silo and excludes the air to such an extent that little heating is possible. Thus crops of immature maize often give rise to sour silage. Again, sour silage is frequently found at the bottom of trench silos—especially if the material has been carted in wet weather, because the trampling of horse and cart over the trench, as well as the super-imposed weight of silage squeezes out the air and limits fermentation. Such defects may be obviated and the sourness reduced if the making of the silage proceeds slowly so that a certain amount of heating may occur in each layer of 3 or 4 ft. before the next layer is put on. This sour silage has a high feeding value, and is quite palatable, despite its unpleasant smell.

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of unnecessary deaths.

This article was pubilshed in New Zealand some years ago. It is so suitable to present Queensland conditions that we reproduce it.

MOTHERCRAFT AND THE TODDLER.

What do We Mean by "Mothercraft"?

BY "Mothercraft" we mean the simple science and the art of correct mothering. Does anyone murmur "the maternal instinct"; does anyone still pooh-pooh the idea of applying science to motherhood, saying, "The bird needs no science, nor the cat, a mammal like ourselves?" To such objectors, we would say, in the vivid words of Dr. C. W. Saleeby: "Just because the human mother is human her forte is not instinct, but intelligence. The insect, avian, and feline mother has instinct in various forms and degrees. The cat never gives her kittens 'the same as we have ourselves,' but her own breast. Within the limits set by a certain range of environment to which they are evolutionary adapted, sub-human mothers 'know' all they need to know—which is well, for they can scarcely learn. To learn is to be intelligent. The human mother is that; but intelligence, whilst it can learn everything, has everything to learn. That is why the sub-human mother (and father, of course), relying upon fixed, well-adapted, ready-made instinct, seems superior to ourselves, who make the most deplorable mistakes from the moment we begin. . . ."

Modern human mothering is an art, not an instinct—else why so many bottle-fed babies, when "the good God gives the milk with every mother?" Why so many delicate babies, dead babies? And why has the death-rate fallen and the standard of infant health risen in the community with the increasing application of rational, scientific principles to the feeding and rearing of babies?

The Mothercraft Ideal.

All over the world people are waking up to these facts, and are striving to achieve the mothercraft ideal, which aims at having every baby naturaly fed, and 100 per cent. healthy, happy, and good; every toddler and school child sturdy and robust; every boy and girl aware of the simple essentials for good parenthood—and so back to the beginning of the cycle again, with the mother, healthy and happy before and after birth of her baby, equipped to rear A1 citizens and to deal serenely and successfully with the dangers and difficulties which may come—in other words, to be "the competent executive in her own home."

A grand ideal for which to work! And how much, how very much, remains to be done, especially with regard to the health of the pre-school child and the teaching of simple mothercraft to school children.

The Health of the Pre-School Child.

We propose to elaborate somewhat on this aspect of the subject in a few forthcoming articles, feeling that it is one of the most urgent and important problems of the times.

Whilst it is true that our infantile mortality rate and the standard of health amongst our babies under one year is unequalled anywhere, it is too sadly true that this standard is by no means generally maintained through the later period from one to five years. The splendid babies of a year to eighteen months' old do not necessarily enter school in the "splendid" class.

The Tragedy of the Teeth.

School doctors and dentists tell a woeful tale of the teeth. The proportion of children in Queensland entering school with perfect, or even reasonably good, sets of teeth is shockingly small. We cannot be satisfied whilst this is the case.

Why do the Children Fall Off in Condition?

Speaking very generally, the babies up to twelve or eighteen months' old are "splendid" because the principles of good mothering are understood and applied to the upbringing of babies, at least in some degree, by the great majority of mothers throughout the country. Again speaking generally, the older children "fall off" because the importance to them of those same principles is not understood, and they are denied the advantages of some at least of the simple essentials for good health—studied diet, regular habits, ample sleep, &c.—which are generally conceded to be necessary during infancy.

Continuity.

As a matter of fact, of course, the life of the child cannot be split up into sections labelled "infancy," "pre-school age," &c. It begins at conception, and during the first nine months is bound up with the health and fitness of the mother, but throughout that period and the whole of infancy and childhood the health and well-being of the child is one problem, governed by the immutable laws of nature.

An Appeal.

There is no royal road to success and no short cut. But there are some first steps, which all can take. First we must frankly face the position and realise that we are not doing the best we can for the "little runabouts." The next step is to seek authoritative advice and conscientiously endeavour to understand and follow it.

We have appealed many times to mothers to bring the older children to the baby clinics at intervals throughout the pre-school period, and we appeal again. It is only by whole-hearted "getting together" on the part of both parents and nurses that the best results can be achieved. Then let us get together to remove this blot on our national record.

TOMATO JAM.

Wash and stem the tomatoes, place in cooking vessel, crush sufficient of the fruit to start boiling, and reduce the whole to pulp by boiling, say for half to three-quarters of an hour. Strain all the pulp through a ¼-inch mesh sieve and weigh. Add ¾ lb. sugar for each pound of pulp, and bring to the boil. The cooking time cannot be stated definitely, there being many influencing factors. Fast boiling for approximately an hour to an hour and a-quarter will produce the desired consistency.

As tomato jam made to this receipe is inclined to be insipid, the addition of a little acid in the form of citric or tartaric or pineapple, &c., is a decided improvement. The addition of acid should be done when the jam is about half cooked, and at the rate of 1 oz. to 25 lb. of pulp. Lemon juice may be substituted for tartaric, and if it is desired to use the whole lemons, they should be cut up into very thin slices and boiled for, say, half an hour before being added to the jam.

Apple pectin added to tomato jam has proved a decided success, supplying bulk, combination, and acid in one.

POINTS IN JAM-MAKING.

Use the best crystallised sugar.

The fruit should be sound and not too ripe.

Boil fast, as this preserves the colour and flavour.

Stir as little as possible, for stirring breaks up the fruit and renders it more liable to burn.

Make small quantities at a time; large quantities are not always a success.

Skim off impurities and do not use iron or tin preserving pans.

Use a wooden or an aluminium spoon for stirring.

Seal the jars down perfectly to keep airtight.

Store in a dry, dark pantry.

Orchard Notes for April.

THE COASTAL DISTRICTS.

IN the Orchard Notes for March the attention of citrus-growers was called to the necessity of their taking the greatest possible care in the gathering, handling, sweating, grading, and packing of the coming crop of fruit, as the returns for the labour expended in the upkeep of their orchards will depend entirely on the condition in which the fruit reaches the market. Many growers fail to realise the very important fact that the success of fruitgrowing does not depend merely on the proper working and management of the orchard, so essential for the production of a good crop of high-class fruit, but that the manner in which the fruit is handled and placed on the market is of even greater importance. In no branch of fruit culture is this more evident than in the case of citrus fruits, as no fruit pays better for the extra care and attention necessary to enable it to be marketed in the best possible condition. Every season there is more or less loss in the consignments sent to the Southern markets, the percentage depending mainly on the weather conditions, the loss in a wet year being much heavier than that in a dry year.

A very large percentage of the loss is due to what is known in the trade as specking—viz., a rotting of the fruit caused by a mould fungus—and this loss can be prevented, provided necessary precautions are taken. Although this matter was dealt with last month, it is of such vital importance to our citrus-growers that it is necessary to again refer to it.

In the first place, growers must clearly understand that specking cannot occur on perfect fruit, the skin of which is free from injury of any kind. The fungus causing specking can only obtain an entry into the fruit through an injury to the skin; it will thus be seen that the remedy for specking is to take every possible care not to injure the skin of the fruit in any way.

Few growers realise how easily the skin of citrus fruits is injured, especially that of fruit grown under moist and humid conditions, when the skin is full of moisture and so tender that the least sign of rough handling causes serious injury, as the cells of the skin are so brittle that they are easily broken, and when so broken a ready means of entry for the mould fungus is provided, and specking follows in due course.

The remedy for specking is in the hands of the grower, who must learn so to gather, handle, and transport the fruit from the orchard to the packing-shed that it does not receive the slightest injury, and further, that when it has reached the packing-shed it must be carefully placed in shallow bins or on trays and be exposed to the air for at least seven days, so that the surplus moisture in the skin may be removed, and the skin thus become toughened and less easily injured. This drying of the skin is known as "sweating," and during the time the fruit is being sweated it should be kept under observation, and all fruit showing signs of specking or injury from fruit flies, sucking or boring insects, mechanical injury or bruising, should be removed.

In order to prevent injuring the skin when gathering, all fruit must be cut and not pulled. Gloves should be used to handle the fruit, and when cut it should be placed in padded baskets or other suitable receptacles. Any fruit that falls or is injured in any way should be rejected, as it is not fit to send to a distant market. At the same time, if the injury is only slight, it can be sent to a local market for quick sale.

For Southern markets only perfect fruit should be selected, and further, it must be graded for size, colour, and quality, and properly packed, only one grade of fruit being packed in a case. The cost of cases, freight, and marketing is now so high that only the best fruit will pay to send to the Southern States, and even the best fruit must be properly graded and packed in order to produce the best returns.

All orchards, vineyards, and plantations not thoroughly clean should receive immediate attention, as from now till the next rainy season the ground must be kept in a thorough state of tilth and free from weeds in order, in the first place, to retain moisture in the soil, and, in the second, to enable birds, ants, and predaceous insects to get at and destroy the pupæ of fruit flies and other pests harbouring in the soil.

Banana and pineapple plantations must be put into good order, and kept free from weed growth.

Land to be planted with trees should be got ready, as, if possible, it is always advisable to allow newly-cleared land time to sweeten before planting.

Farm Notes for April.

FIELD.—Those areas already lying in fallow for subsequent sowing with wheat should be kept in good tilth, using field implements that have a stirring effect in preference to those which tend to reverse the surface soil. The surface should never be allowed to cake; consequently all showers must be followed by cultivation, as soon as conditions will permit of teams and implements working freely.

Early fodder crops, such as barley (skinless or Cape) and certain varieties of wheat may be sown during April. Growers of winter fodders will be well advised to study the article dealing with dairy fodder plots which appeared in February, 1922, Journal.

Potatoes should now be showing good growth, and must be kept free from all weed growths by means of the scuffler. If sufficiently advanced, and any doubt exists as to the prevalence of blight, advantage should be taken of fine weather to give a second spraying of "burgundy mixture," a calm and somewhat cloudy day being chosen if possible for the spraying.

Where land has been previously well prepared, lucerne sowing should be carried out this month, and intending growers of this fodder will be well advised to ascertain the germinating qualities of seed submitted to them for purchase. The difference between a good and bad "strike" is often traceable to the poor class of seed sown.

Maize and cotton crops should now be in the harvesting stage, and, once matured, are better in the barn than the open paddock, where weevils and other insects are usually prevalent at this season of the year.

Root crops sown last month should now be making fair growth, and during the early period of such should be kept free from weeds, and where necessary thinned out. Sowings of mangels, swedes, field carrots, sugar-beet, and rape may still be made where conditions of moisture will permit.

As the sowing season is close at hand for certain varieties of wheat—i.e., those which require a fairly long period to develop in—every effort should be made to bring the seed-bed into the best possible tilth and to free it from foreign growths of all kinds. The grading of all seed-wheat is strongly recommended, and growers who favour certain varieties should adopt a system of seed selection from prolific strains with a view to the raising of larger quantities of pure typical grain for ultimately sowing in their larger fields.

Pickling of wheat to prevent smut (bunt) is necessary. Germination tests should be carried out prior to commencing seeding operations.

Sorghums which have matured and are not immediately required as green fodder should, wherever possible, be conserved as ensilage to provide for a reserve, to tide over the period when grasses and herbage are dry. Succulent fodder of this description is the best possible form of insurance against drought, and for maintaining dairy and other stock in thrifty condition.

TO SUBSCRIBERS—IMPORTANT.

Several subscriptions have been received recently under cover of unsigned letters. Obviously, in the circumstances, it is impossible to send the journal to the subscribers concerned.

It is most important that every subscriber's name and address should be written plainly, preferably in block letters, in order to avoid mistakes in addresses and delay in despatch.

CLIMATOLOGICAL TABLE—JANUARY, 1934.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature. Means. Max.	Means. Min.	Extremes. Max.	Date.	Min.	Date.	Rainfall. Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·75	87	74	90	6	68	31	1,603	19
Herberton	..	78	64	88	5	61	19	1,866	23
Rockhampton	29·89	88	70	98	8	65	13,15,17	177	10
Brisbane	29·97	82	67	92	9	62	23	326	9
Darling Downs.									
Dalby	29·93	86	62	97	1	50	11	213	4
Stanthorpe	..	78	56	90	26	41·4 Record.	11	406	12
Toowoomba	..	78	61	90	1	50	12	542	10
Mid-interior.									
Georgetown	29·77	91	70	99	15	66	23, 24, 26-31	1,223	12
Longreach	29·82	97	72	111	5	62	18	132	2
Mitchell	29·88	90	66	99	1, 2, 3	49	11	80	6
Western.									
Burketown	29·74	94	77	104	21	70	13	590	8
Boulia	29·76	99	76	113	5	66	8	410	4
Thargomindah	29·83	97	74	105	1, 3	62	11	10	3

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF JANUARY, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING JANUARY, 1933, AND 1932, FOR COMPARISON.

Divisions and Stations.	Average Rainfall. Jan.,	No. of Years' Records.	Total Rainfall. Jan., 1934.	Jan., 1933.
North Coast.	In.		In.	In.
Atherton	12·01	33	22·09	8·41
Cairns	16·78	52	23·72	5·59
Cardwell	16·79	62	46·17	12·16
Cooktown	14·55	58	16·03	5·34
Herberton	9·60	48	18·66	6·55
Ingham	15·69	42	31·23	2·45
Innisfail	20·41	53	35·60	6·12
Mossman Mill ..	17·41	21	33·75	8·40
Townsville	11·11	63	13·87	5·99
Central Coast.				
Ayr	11·23	47	9·60	5·16
Bowen	10·18	63	8·06	7·36
Charters Towers ..	5·48	52	6·93	1·76
Mackay	14·48	63	5·38	9·05
Proserpine	16·28	31	7·75	5·34
St. Lawrence ..	9·47	63	0·87	3·40
South Coast.				
Biggenden	5·40	35	0·39	9·31
Bundaberg	8·97	51	1·28	12·50
Brisbane	6·45	83	3·26	10·01
Caboolture	7·72	47	4·34	4·91
Childers	7·67	39	1·28	8·23
Crohamhurst.. ..	12·61	41	9·21	7·09
Esk	5·73	47	4·83	5·96
Gayndah	4·70	63	0·52	6·40
Gympie	6·72	64	3·24	6·67
Kilkivan	5·60	55	2·79	5·46
Maryborough ..	7·28	63	2·44	5·61
Nambour	9·88	38	4·98	5·72
Nanango	4·69	52	2·14	4·48
Rockhampton ..	7·83	63	1·77	12·44
Woodford	7·91	47	5·75	4·89

Divisions and Stations.	Average Rainfall. Jan.,	No. of Years' Records.	Total Rainfall. Jan., 1934.	Jan. 1933.
Central Highlands.	In.		In.	In.
Clermont	5·21	63	1·78	11·44
Gindie	3·83	35	0	5·51
Springsure	4·27	65	0·29	5·03
Darling Downs.				
Dalby	3·28	64	2·13	4·44
Emu Vale	3·19	38	3·89	5·08
Hermitage	3·24	28	3·67	6·48
Jimbour	3·54	46	1·56	4·12
Miles	3·63	49	3·77	3·46
Stanthorpe	3·57	61	4·06	7·52
Toowoomba ..	5·07	62	5·42	9·40
Warwick	3·56	69	3·90	7·48
Maranoa.				
Roma	3·14	60	0·55	2·22
State Farms, &c.				
Bungeworgorai ..	1·84	20	0·54	1·38
Gatton College ..	4·30	35	4·54	10·26
Kairi	9·32	20	20·82	5·04
Mackay Sugar Experiment Station	14·57	37	5·01	7·27

GEORGE G. BOND, Divisional Meteorologist.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

MOONRISE.

	March, 1934.		April, 1934.		Mar, 1934.	April, 1934.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	5·45	6·25	6·2	5·50	6·11	6·17
2	5·46	6·24	6·3	5·49	6·41	6·55
2	5·46	6·22	6·3	5·48	7·11	7·41
4	5·47	6·21	6·4	5·47	7·42	8·35
5	5·48	6·20	6·4	5·46	8·18	9·35
6	5·48	6·19	6·5	5·45	8·58	10·39
7	5·49	6·18	6·6	5·43	9·44	11·45
8	5·49	6·17	6·6	5·42	10·38	..
						a.m.
9	5·50	6·16	6·7	5·41	11·39	12·53
10	5·51	6·14	6·8	5·40	a.m.	1·57
11	5·52	6·13	6·8	5·38	12·45	3·1
12	5·52	6·11	6·9	5·37	1·52	4·4
13	5·53	6·10	6·9	5·36	3·3	5·4
14	5·54	6·9	6·10	5·35	4·9	6·3
15	5·55	6·8	6·10	5·34	5·14	7·3
16	5·56	6·6	6·11	5·33	6·17	8·6
17	5·56	6·5	6·11	5·32	7·18	9·5
18	5·56	6·4	6·12	5·31	8·21	10·1
19	5·56	6·4	6·12	5·30	9·20	10·53
20	5·56	6·3	6·13	5·29	10·21	11·43
						p.m.
21	5·56	6·2	6·13	5·28	11·17	12·28
22	5·56	6·1	6·14	5·27	12·12	1·6
					p.m.	
23	5·56	6·1	6·14	5·27	1·2	1·39
24	5·56	6·0	6·15	5·26	1·49	2·11
25	5·57	5·58	6·15	5·25	2·32	2·40
26	5·57	5·57	6·16	5·25	3·9	3·10
27	5·58	5·55	6·16	5·24	3·41	3·41
28	5·59	5·54	6·17	5·24	4·12	4·14
29	6·0	5·52	6.17	5.23	4·41	1·51
30	6 1	5·51	6·18	5·22	5·12	5·35
31	6·2	5·50	..	..	5·44	..

Phases of the Moon, Occultations, &c.

1 Mar.	○ Full Moon	8 26 p.m.
9 ,,	☽ Last Quarter	4 6 a.m.
15 ,,	● New Moon	10 8 p.m.
23 ,,	☾ First Quarter	11 44 a.m.

Perigee, 12th March, at 7.42 p.m.
Apogee, 24th March, at 3.54 p.m.

Neptune, in Leo, 12 degrees east of Regulus, will be in conjunction with the full moon, which will be passing it 3 degrees to the south on the 1st. It will be in opposition to the Sun on the 2nd.

Jupiter, in Virgo, within 3 degrees of Spica, will be passed by the Moon at 7 a.m. on the 5th.

Mercury will be in inferior conjunction with the Sun on the 6th, but being 3 degrees further north there will be no transit across the Sun's face.

The occultation of Antares, in Scorpio, on 8th March, will occur below the horizon of Warwick, the hour-angle being 8 hours 6 minutes west.

On 11th March Venus will again almost recover its great brilliance, as in December last.

Venus will be in conjunction with the Moon 4 hours after they have both set on the 12th.

Saturn will be in conjunction with the Moon on the 13th, about 2 hours after they have set.

Mercury will be in conjunction with the Moon on the 14th when both are too near the Sun to be seen.

At 2 p.m. on the 16th the Moon will pass 5 degrees north of Mars; on the 18th at 9 a.m. the Moon will pass Uranus, 6 degrees on its northern side.

The Sun will reach the junction between the ecliptic and the celestial equator on 21st March, and will pass from the southern to its northern side, the day and night each having 12 hours.

On the 29th at 7 a.m. the Moon will be passing Neptune at a distance of 3 degrees.

Mercury sets 14 minutes after the Sun on the 1st; on the 15th it rises at 4.41 a.m.

Venus rises at 3.28 a.m. on the 1st and at 2.53 a.m. on the 15th.

Mars sets at 6.57 p.m. on the 1st and at 6.30 p.m. on the 15th.

Jupiter rises at 8.26 p.m. on the 1st and at 7.29 p.m. on the 15th.

Saturn rises at 4.21 a.m. in the 1st and at 3.33 a.m. on the 15th.

Mercury will be near the border of Aquarius and Pisces, Right Ascension 23·14 on the 1st, moving westward into Aquarius to R.A. 22·59 on the 31st.

7 April	☽ Last Quarter	10 48 a.m.
14 ,,	● New Moon	9 57 a.m.
22 ,,	☾ First Quarter	7 20 a.m.
29 ,,	○ Full Moon	10 45 p.m.

Perigee, 7th April, at 9.12 p.m.
Apogee, 21st April, at 11.42 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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QUEENSLAND AGRICULTURAL JOURNAL

VOL. XLI. 1 APRIL, 1934. PART 4.

Event and Comment.

The Dairy Industry.

"DAIRY farming has ceased to be merely an application of manual labour yielding satisfactory results; it is now a combination of energy, skill, scientific knowledge, and economics." That was one of the telling points made by the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, in a brief address of welcome to the Dairy Committee leaders on the occasion of their visit to the Department in the course of the month. Continuing, Mr. Bulcock said that with the idea of giving practical assistance to primary industry, legislation had been passed and applied with the object of enabling the producer to get the best out of his farm along the most economical lines. By taking the line of least resistance it was quite easy to avoid adverse criticism; but it would also be agreed that adverse criticism when soundly based could not be entirely disregarded.

Causes of economic loss in the dairy industry could be roughly classified into three groups—neglect of the means provided for herd testing; the keeping of inferior stock; and animal diseases. Some of the factors contributing to loss of income could be controlled by the farmers themselves co-operating when necessary with the officers of the Department of Agriculture and Stock. Herd recording commended itself as one of the essentials of profitable dairy practice. While there was evidence of a growing desire among dairy farmers in Queensland to adopt systematic herd testing, a disinclination was observable in some quarters to contribute to the carrying out of that work. Discussing matters

relevant to modern dairy practice, the Minister said that if a commodity board were merely a marketing board, then the consumer would be at the mercy of that board. Production, however, could be made much cheaper, and the existence of a commodity board in an industry should be a stimulus to greater efficiency in that industry. Since the year 1931-32, the dairy farmers of Queensland had gained an advantage of £154,576 over the producers of New South Wales, and £218,446 over the producers of Victoria. Last year the advantage over New South Wales amounted to £84,000, and over Victoria to £141,000. Those substantial amounts represented the contributions made by the purchasing public to the dairy industry. Queensland people recognise the necessity of primary producers receiving prices for their products that made conditions of country life reasonably satisfactory; but if they were prepared to pay those prices they had a right to demand the highest degree of efficiency in the industry.

Herd Testing.

CONTINUING his address to the visiting dairy leaders, Mr. Bulcock said that there were 880 herds under official test in Queensland, a very great increase on previous figures. That was evidence of a growing desire to get rid of the "boarder" and build up herds from which a fair financial return might be expected. The distribution of the dairy herds undergoing test was West Moreton, 160; Darling Downs, 260; Central District, 200; Atherton Tableland, 20; and directed through the head office of his Department, 240. Over 700 purebred cows were under official test, a material contribution to the work of dairy herd improvement. He pointed out that no man could succeed unless he was prepared to engage in every possible phase of economic dairy practice; and that was the reason why Local Producers' Associations had been asked to select dairy leaders with the object of their visiting the Department to familiarise themselves with the activities of the Dairy and Stock Branches. Such visits would enable them to appreciate the importance and the value of the work that was being done by his Department every day in the interests of the primary industries of the State. They would also be able to assess the difficulties encountered in the direction of the dairy industry and in the administration of the legislation by which it was governed; and also observe the efficacy and extent of the measures devised for the surmounting of those difficulties.

Herd Improvement.

STRESSING the importance of a continuous policy of herd improvement, Mr. Bulcock referred to the economic losses resulting from the keeping of inferior stock. Everybody, he told the dairy leaders, would recognise the necessity for getting the best dairy stock that was possibly obtainable. There did seem, however, to have been an attempt, by persons seeking party political preferment and others, to assail the policy of encouraging farmers to keep only the very best stock in their dairy herds. Although the precept issued recently on the commodity boards of the dairy industry for the purposes of the "better bull scheme" only amounted to £5,000 a year in all, the State made a contribution equal to the amount subscribed by the industry; but that £1 for £1 contribution by the Government by no means represented the whole of the public money spent on dairy research and administrative work, which, unquestionably, was of the utmost value to the dairy industry.

Stock Diseases.

DISCUSSING economic losses due to the incidence of animal diseases, Mr. Bulcock said that Departmental effort had been persistently misrepresented in some quarters, particularly in respect of contributions required from the industry to assist in the solution of some of the pathological problems which confronted all engaged in animal husbandry. The control of disease required the employment of trained men. In regard to the control of stock diseases generally, the producer had an obligation to the public, for some diseases, such as bovine tuberculosis, were communicable to man; the producer also had an obligation to himself, for heavy economic loss was involved in the milking of diseased cows, which had to be destroyed ultimately. The Minister pointed out that that phase of animal husbandry was claiming the attention of all Departments of Agriculture where dairying was an industry of any magnitude. A sum had been placed on the Estimates by the Government, and a board constituted—after consultation with the dairy leaders of the State—to spend that money judiciously in improving the industry. He stated that he had never asked the board to interview him, unless the board had first expressed a desire to discuss dairying matters with him. There was room, he added, for the extension of the veterinary staff of the Dairy Branch of the Department, for one of the most urgent matters for attention was the control of disease. Dairy inspectors, from time to time, were brought in from their districts to undergo refresher courses at the Animal Health Station at Yeerongpilly, in order that they might acquire or refresh their knowledge of modern methods of disease control and return to their posts as, virtually, field officers of that Station. If the Queensland dairy industry were allowed to remain on the ground it at present occupied, then the industry in other States and other countries would forge ahead of it. Their costs of production would be lower, with the natural consequence of their being able to sell at lower prices. If that happened, the Queensland industry would deteriorate, without their having even the satisfaction of knowing that every effort had been made to save it.

Stabilisation of the Dairy Industry.

MR. BULCOCK concluded his address to the dairy leaders with the statement that the stabilisation legislation passed by the Federal Parliament and the Parliaments of New South Wales, Victoria, Tasmania, and Queensland was the consummation of the desire to establish an Australian price, based on Australian conditions, for dairy produce, in order that the domestic market would not be subject to the fluctuations that had proved so detrimental to the industry generally. The Australian market would be a more profitable market to the producer when stabilisation was effectively established. The Queensland market had been inundated with butter from New South Wales and Victoria—to a greater degree from Victoria—and every pound of butter from the South displaced a pound of their own butter on their own local market. The stabilisation scheme would prevent the dumping of Southern butter upon the local market, unless, of course, it was offered at Australian parity. The Queensland industry would, in consequence, benefit very substantially, but the community, obviously, could not be expected to pay a premium on inefficiency. The Queensland industry must, therefore, safeguard itself against economic loss in the directions he had specified by aiming at the attainment of the highest possible degree of dairying efficiency.

The Call of the Land.

WHAT ST. LUCIA TRAINING FARM IS DOING.

By FRANK W. BULCOCK, Minister for Agriculture and Stock.

THE cry, "Go on the land, young man," is raised in periods of adversity as well as in times of prosperity. It is one of those generalisations that often do more harm than good, for qualification is needed. This qualification should be—"Go on the land, young man, if you have an inclination in that direction." Successful farmers are the product of physique, character, and training, and never in the history of Australia has more attention been paid to these phases of development.

The indiscriminate selection of city youths for country pursuits is doomed to failure, but, given a proper system of selection, there is no doubt that many youths will find contentment and happiness in primary pursuits.

The pessimist is inclined to say, "Why put more people on the land when those already engaged in rural pursuits are not earning a competence?" And it is an argument that warrants serious consideration.

Our Agricultural Destiny.

There are a number of reasons why a State must engage in an active "young man's" land movement under proper conditions. First, if we agree that the limits of production have been reached, then there is no hope in the future for Queensland, in common with Australia generally. We cannot escape our agricultural destiny, and, therefore, must wisely direct it. Wise direction must be the very opposite of the policy of despair that is associated with restriction of land settlement. Rather must we produce with skill and distribute with wisdom.

Queensland is a primary producing State, and, while we are labouring under the cloud of depression, it is natural to expect that our primary industries will suffer, but economic surveys show that these periods of depression alternate with periods of prosperity. One of the great difficulties confronting the statesmen and economists of the world is to regulate the phases of economic interplay and evolve a system whereby a general, satisfactory average shall be obtained. This surely is not beyond the ability of mankind, and agricultural history of recent years shows distinct evidence of stabilisation. Australia can never agree to a policy of general limitation of production, and I believe that this phase, which is associated with present circumstances, will pass away with the passage of the conditions that have given rise to the advocacy of restriction.

The time, therefore, to prepare for the farming future of the State is now, and the material to employ is the youth, both of the country and city. It might reasonably be asked what attraction does a farming life offer over and above the life of an industrial unit in the city? Parents, generally, should weigh that question seriously in defining the future of a son.

Life on the Land.

It is obvious that industry depends on agriculture, and, with the expanding policy of the fulfilment of national requirements within the nation, the expansion of secondary industries depends on the expansion

of agriculture within our Commonwealth. Nor can we assume that in industry every youth will become a captain of industry, but every youth may become an independent farmer. There are periods of anxiety on the land. One cannot minimise the risk of drought, disease, and crop failure, but the farmer has a home, and he is never confronted with that soul-destroying problem of unemployment. This cannot be said for the city artisan.

A survey of present prospects cannot encourage parents to hope for the speedy employment of their sons in industrial occupations, and an additional handicap is the ever-increasing volume of girls and women who now find employment in industry. Queensland has the lands and has the adaptable youth, but the problem of bringing these two together is difficult of adjustment. I believe it lies particularly in an appreciation on the part of parents of the merits of a farm career for their sons, the promotion of a land consciousness and, lastly, a recognition of the channels through which a youth should pass in order to be a farmer.

Training is Essential.

From time to time parents interview me and seek advice as to the wisdom of investing their savings in a farm for a son. Invariably the advice I tender is against this course. A youth without previous training cannot succeed on the land in the way he would succeed were he trained. At one time the most popular expressions to designate the farmer and settler were "cocky," "way back," and "country cousin," each term carrying with it a suggestion of inferiority.

A few years ago it was not popularly supposed that a farmer was a scientist combining skill and resource to wrest a living from the soil. To-day this viewpoint has disappeared, and farming is rightly regarded as a dignified and worthwhile occupation. The farmer of the old school is disappearing and giving place to the younger men, who have an appreciation of and respect for agricultural education and research in all its many phases. Farming is a difficult occupation. It calls for resource, physical capacity, and intelligence. The theory that any man can be a farmer is entirely wrong, but as farming develops the national traits of perseverance and resource we need not fear on this score.

As a compensation for the difficulties associated with farming the Government maintains a very extensive agricultural organisation which is at the service of the farmer on all occasions.

St. Lucia Training Farm.

The question now arises—what should be done to discover whether or not a lad is likely to develop land mindedness? With this end in view the St. Lucia training farm was established. Here, under pioneer conditions, fifty boys are put through a rudimentary course in agriculture. We have not endeavoured to surround the boys with a luxury of farming equipment to which they cannot aspire immediately in their own enterprise, but we have succeeeded in awakening a land consciousness within the minds of many of our students, who are drawn from unemployed sources, and the demand for these boys is greater than the supply.

We pursue a follow-up policy in regard to our ex-students, and it is satisfactory to note that, in the vast majority of cases, these boys have settled down to farming pursuits in a splendid manner. There is no suggestion that all boys enrolled at St. Lucia are potential farmers, but,

as far as possible, we impress on the boys their obligation to themselves to become independent farmers, when training is complete and opportunity offers.

The boys who leave St. Lucia are not competent farmers, but the aims of the farm would be defeated if we sought to turn out a batch of farm labourers. St. Lucia is a successful experiment in preliminary farm training, and the attention of parents of unemployed boys is drawn to the advantages such a farm offers, combining as it does both training and the distinct promise of employment.

One of the great handicaps to engaging in farm pursuits is the problem of finance, and in order to meet this difficulty the Agricultural Bank was established. Under various managers it has made a material contribution to agricultural finance and stability. In addition to the bank's ordinary programme there was placed on last year's Estimates the sum of £50,000 for the purpose of assisting persons who do not fall within the category of those who are qualified for assistance from the bank. This fund has been of great assistance to many persons who required short-term credit for small amounts to tide them over occasional periods of adversity.

These things are mentioned in the hope that youths may realise that the State is prepared to find finance for the settler who desires to capitalise his efforts, and whilst no "wet nursing" is practised, yet the Agricultural Bank and the Rural Assistance Board are available for the purpose of providing for agricultural finance.

Personally, I believe that the land offers bright opportunities for many of our youths. Let a youngster whose mind is turning to agriculture ask any farmer of his acquaintance if he would abandon farming and take to the hazardous life of an industrial city dweller. I rather fancy the answer will be an emphatic NO!

TO NEW SUBSCRIBERS.

New subscribers to the Journal are asked to write their names legibly on their order forms. The best way is to print your surname and full christian names in block letters, so that there shall be no possibility of mistake.

When names are not written plainly it involves much tedious labour and loss of valuable time in checking electoral rolls, directories, and other references. This should be quite unnecessary.

Some new subscribers write their surname only, and this lack of thought leads often to confusion, especially when there are other subscribers of the same surname in the same district.

Everything possible is done to ensure delivery of the Journal, and new subscribers would help us greatly by observing the simple rule suggested, and thus reduce the risk of error in names and postal addresses to a minimum.

PLATE 105.

CONFERENCE OF MINISTERS OF AGRICULTURE, HOBART, 19TH TO 23RD FEBRUARY, 1934.

Back Row (left to right): Messrs. J. T. Thynne, ———, H. Luckman, R. P. M. Short, J. M. Ward, H. Thompson, J. T. Armstrong, C. G. Savage, L. S. Smith, P. H. Thomas.

Second Row: Messrs. H. C. Smith, E. A. Kendall, Miss Jean Easton, Messrs. G. L. Sutton, R. Wilson, G. D. Ross, F. E. Ward, H. A. Mullett, A. J. Perkins, L. T. MacInnes, E. C. T. Philp, H. B. Barlow.

Front Row (seated): Hons. H. Millington (W.A.); A. P. Blesing (S.A.); H. Main (N.S.W.); A. L. Wardlaw (Tas.); J. Allan (Vic.); F. W. Bulcock (Q.).

Products of the Hive.

By HENRY HACKER, F.E.S., Entomological Branch.

EVERYONE knows that honey is the principal product of the apiary, but it may not be so generally realised that in the hive other products are being handled and manufactured by the bees. The following notes have, therefore, been compiled in order to give some idea of the hive products, their nature, and relative value. As honey constitutes the chief product of the hive it will be considered first, the other products in their order of importance being beeswax, pollen, and propolis.

Honey.

Nectar is the raw material from which the bees manufacture honey, and it consists chiefly of a solution of sugars with small amounts of other materials, including colouring matter, and those ingredients which give to honeys their characteristic flavours.

The field bee derives its supplies from the successive blooms of a great variety of trees, shrubs, and other cultivated and wild plants, of which those belonging to the order *Myrtaceæ,* which include the Eucalypts, are by far the most important in this State.

When first gathered nectar is a thin watery liquid possessing a raw, rank taste. To make from this raw product the wholesome and delicious food which honey constitutes, is one of the functions of the worker bee.

There have been two theories offered to explain how the honey-bee reduces the high water content of nectar to the low water content of honey; these are known as the excretion and the evaporation theories. The first of these is based largely upon the well-known observation that bees carrying nectar often eject a tiny spray of colourless liquid. This was assumed by some of the earlier observers to be the result of a process within the body of the bee whereby some of the excess water was eliminated from the nectar while the bee was carrying it to the hive. Largely as a result of experiments made by O. W. Park, in Iowa, United States of America, it is now known that the evaporation theory is the correct one, and the evaporation of nectar is carried out within the hive. The nectar-carrying bee, upon her return from the field, delivers her load to one or more house-bees, which then put the nectar through a process of kneading with their mouthparts, which apparently reduces its water content and probably permits the addition of enzymes, such as invertase, which are said to be produced by the salivary glands. Park also observed that instead of depositing the entire load in a single cell, the house-bee often distributes it by attaching a small hanging drop to the roof of each of several cells; these small hanging drops present relatively large surfaces from which moisture can evaporate rapidly. Later the droplets are collected, and it is assumed that they are again put through the process of manipulation by the mouthparts.

The evaporation of the nectar is carried to a further stage by worker-bees which station themselves in line near the hive entrance. These, by the continual buzzing of their wings, drive currents of air

into and out of the hive and over the comb surfaces. If the hand is held before the entrance at such a time a strong current of warm air may be felt coming out. The loud buzzing heard at night during the summer time is due to the wings of workers engaged chiefly in ripening nectar. When finally this process is completed, it is found that the water content has been reduced to about 15 to 20 per cent., and that the disagreeable odours and flavours, probably due to volatile oils, have also been driven off. The finished product is stored in cells above and around the brood nest and the main cluster of bees. The work of sealing with waxen caps then goes forward rapidly, the covering being more or less porous. This sealing of the cells indicates to the bee-keeper that the honey is "ripe," and in the right condition for extraction.

Ordinarily honey is judged by its colour, flavour, and density. The very great range in its colour is due entirely to the sources from which it is obtained. The colour varies from almost white, through straw and amber to reddish. It has been known to be blood red, and again to have a greenish tinge, and still be absolutely pure. The aroma and flavour of the honey varies also very considerably. White clover and lucerne honeys are generally admitted to a preference as to appearance and flavour, although many people who are used to the more strongly flavoured eucalyptus honeys consider the former to be rather insipid. It must be noted, however, that lightness of colour alone is no conclusive evidence of superior quality, and honey of the darker colours, as well as honey of the lighter colours, may be of the higher grades and quite suitable for table use. Some of the most prized honeys, as for instance that gathered from orange blossoms, is of very deep colour, while the famous heather honey of Europe is quite dark, and yet no honey stands higher in popular esteem on that continent.

Honey is marketed in three principal forms—extracted or liquid honey, which has been separated from the uncrushed comb by centrifugal force or gravity; comb honey contained in the cells of comb, usually in 1 lb. sections; chunk honey which is sometimes retailed here, in which comb is cut into rectangular pieces and placed in the container with the liquid honey, which, if packed in glass, increases the attractiveness of its appearance.

The very great proportion of the honey produced is the extracted variety. Bees are ordinarily able to produce a larger quantity of honey if they are not compelled to build comb for it, and by emptying the combs and replacing them in the hive, the bee is able in periods of heavy nectar secretion to proceed immediately to the storage of more honey.

The production of comb honey requires much greater skill and experience on the part of the beekeeper, and can only be carried out successfully in limited areas where the conditions are favourable. It should not be attempted in localities where the honey flow is slow or intermittent, where the character of the honey flow is such that it granulates quickly in the comb while it is on the market, or where the honey is dark in colour. Local market conditions in some instances may, of course, be such as to make it seem advisable to produce comb-honey in limited quantities in a locality that is not well suited to comb-honey production, but the beekeeper who expects to produce comb-honey for the general market should first be sure that his is a comb-honey locality.

Almost all honeys granulate or "candy" after a certain time. Those which are high in dextrose or grape sugar will granulate very quickly after being exposed to the air by extraction. Granulation is hastened during periods when there is the greatest difference between day and night temperature. Conversely, the liquid condition may be maintained best by exposure to moderate heat; for instance, a honey which ordinarily granulates quickly may remain liquid for years if stored under a roof exposed to the sun. For this reason, storekeepers commonly keep their stocks on the warmer top shelves of their stores.

The following information relative to the sale of Australian honey in the United Kingdom is taken from a recent report issued by the Empire Marketing Board:—

"The greater part of Australian honey is marketed in England under the label 'Golden Wattle,' the brand applied to the produce of the Australian honey co-operative associations shipped to their agents, the Overseas Farmers' Co-operative Federations Limited.

"The term 'blend' in connection with honey has several shades of meaning. In the country of origin, honey from many farms and apiaries is blended in preparation for export; on arrival in the United Kingdom, honey from different parts of a single country may be blended to produce a standardised representative type; and again, honeys from several countries are frequently mixed or blended together.

"After blending, the honey is placed in small containers for retailing. The most popular type is the glass jar which, with an effective label, presents a clean appearance and shows the clearness and colour of the honey.

"Australian honey was stocked in about 10 per cent. of the London shops stocking honey, and was classed among the less expensive honeys. London prices for the 1-lb. glass jar ranged from 11d. to 1s. 6d., 1s. 3d. and 1s. 4d. being the most usual prices, while the ½-lb. jar was generally retailed at from 8½d. to 10½d.

Manufacturing Demand.

"*Chemists.*—The two pharmaceutical preparations containing honey which are in widest use are oxymel of squill, an important constituent of many cough mixtures, and honey borax. Honey is also widely used in the manufacture of proprietary cough cures, balsams, and lung tonics.

"*Confectioners.*—The products in which honey mostly occurs are chocolates, where it is chiefly used to form centres, but it is also employed in the manufacture of toffee, turkish delight, caramels, and nugat.

"*Bakers and Biscuit Makers.*—Honey is used to a limited extent in the making of cakes, biscuits, rusks, and gingerbread, mainly for flavouring; dark honey is used for colouring certain kinds of biscuit, while honey is said to have a preservative effect in cakes and gingerbread, maintaining in the product a palatable moisture."

Beeswax.

Beeswax is secreted by special glands in honey-bees of a certain age, which are situated on the ventral surface of the abdomen. A reasonably high temperature and a honey flow are necessary for its

production. If the bees are closely watched under these conditions, little pearly discs of wax somewhat resembling fish scales will be seen protruding from between the segments on the underside of the abdomen. These wax scales are scraped off with the spines of one hind leg, then pushed forward and grasped by the front legs and transferred to the mandibles, where they are manipulated or masticated, after which they are applied to the comb. During the process, the bee stands on three legs, the two intermediate legs and one hind leg not in action, while the other hind leg and the two fore legs, in connection with the mandibles, perform the manipulation. Each individual bee removes its own wax scales without any assistance.

At the time a swarm is hived, there is no wax in the hive under natural conditions. The wax secretions, however, become very active, and in an extremely short time the hive is supplied with combs. It is also true, of course, that wax is secreted at any time during the active season, when it is necessary that more combs be built to accommodate brood or stores, provided, of course, that there is room. If a comb is removed from the centre of the brood chamber or from the super, it is replaced as needed, but, as a rule, not so rapidly. The rapidity of the honey flow influences this wax secretion greatly.

Notwithstanding the fact that wax is a more valuable article than honey, it pays the beekeeper of to-day to produce honey in preference to making the bees expend their energies in the production of wax. With modern methods of extraction the honey is removed from the combs, and these are again given to the bees or carefully stored away for use during the following season. The wax which the beekeeper now obtains results from the melting-up of cappings, old combs, or combs exhibiting faults, such as stretched cells, or those having too great a proportion of drone cells.

Beeswax has many uses both in the arts and in commerce, and fresh uses are continually being found for this product. A very satisfactory floor finish can be made by melting 1 lb. of beeswax, and while it is cooling, stirring into it some turpentine, the proportion varying according to whether the mixture is required to be thin or thick. Certain grades of blacking, harness oils, and lubricants require pure beeswax in their manufacture. Large quantities of beeswax in the form of candles are used in churches. The electrical supply business is a large consumer; the windings of the electric wires are soaked in beeswax to prevent their being affected by extremes of heat or moisture. Even the dentistry profession consumes large quantities every year to take impressions in the mouth. Last, but not least, the beekeeper himself is a large consumer as well as a producer of wax.

Pollen.

Pollen is the reproductive substance of flowers, which is transferred from the male to the female portion of the flower or from the male flower to the female flower for the reproduction of the species. Nature has provided various methods for this transfer. Amongst these are flying insects, of which bees are the principal. Pollen is highly nitrogenous and contains necessary vitamins. Nature is always prolific, and provides more than is necessary for reproduction purposes. Bees, as they visit flower after flower, carry the pollen from the anthers and fertilize the styles. In doing this they take a toll for their service, and carry some of the surplus pollen away to their hives to make food for

their young larvæ. When breeding is taking place, the nurse bees convert honey and pollen into chyle food, which is deposited in the larval cells. Pollen is generally yellow or orange in colour, but it may be other colours, such as white, green, or blue, according to the source from which it is obtained.

Pollen may be collected by the worker-bee upon its mouthparts, upon the brushes of its legs, and upon the hairy surface of its body. When the bee collects from small flowers, or when the supply is not abundant, the mouthparts are chiefly used for gathering it. The specialised brushes on the legs are used to remove the pollen grains from the body and transport it to the pollen baskets of the hind legs.

The pollen grains are slightly moistened with honey to make them cohesive, and after the load has been carried to the hive it is deposited by the bee within one of the cells of the comb. It is then packed in the cell by some other worker, which flattens out the rounded masses and adds more fluid to them.

Propolis.

Propolis is known to every beekeeper under its commercial name of "bee glue." Its source has been questioned recently, but ordinarily it is supposed to be collected by the bees from the waxy bud scales and other parts of various trees. In any case, the bees bring it in from the field in much the same manner as pollen. Their uses for it are many; with it the frames are cemented in place, the covers and bottom boards are glued fast to the hive body, the hive entrance is contracted, and cracks are stopped against cold draughts and robber bees. During a recent inspection tour, mounds of propolis were seen on the floor of several hives, and a further examination showed a dried mouse under each mound. The mice had evidently crept into the hives and had been stung to death by the bees, but finding that the bodies were too heavy to drag out, the bees had sealed them to the floor of the hive with a thick coating of propolis. Because it liberates a very pleasant odour while burning, it sometimes serves as a sort of incense, especially for church rites. Much propolis is said to be used in Europe and elsewhere for this purpose, but there is no market for the substance in Queensland.

TO SUBSCRIBERS—IMPORTANT.

Several subscriptions have been received recently under cover of unsigned letters. Obviously, in the circumstances, it is impossible to send the Journal to the subscribers concerned.

It is most important that every subscriber's name and address should be written plainly, preferably in block letters, in order to avoid mistakes in addresses and delay in despatch.

Parasitic Worms of Poultry.

By P. RUMBALL, Poultry Expert.

A LARGE number of animal parasites are found in the digestive tract of poultry, some of which cause serious disturbance of the digestive functions, while others are apparently harmless. Those usually met with, however, may be classed as round worms (nematoda) and tape worms (cestoda). The former, by reason of the fact that they are the more common, claim prior attention. Various worms are found in the crop, stomach, gizzard, intestines (both upper and lower portions), and the blind gut. The lastmentioned are responsible for serious losses and are particularly hard to expel. The accompanying plates should give poultry breeders some idea of the extent to which infestation is possible.

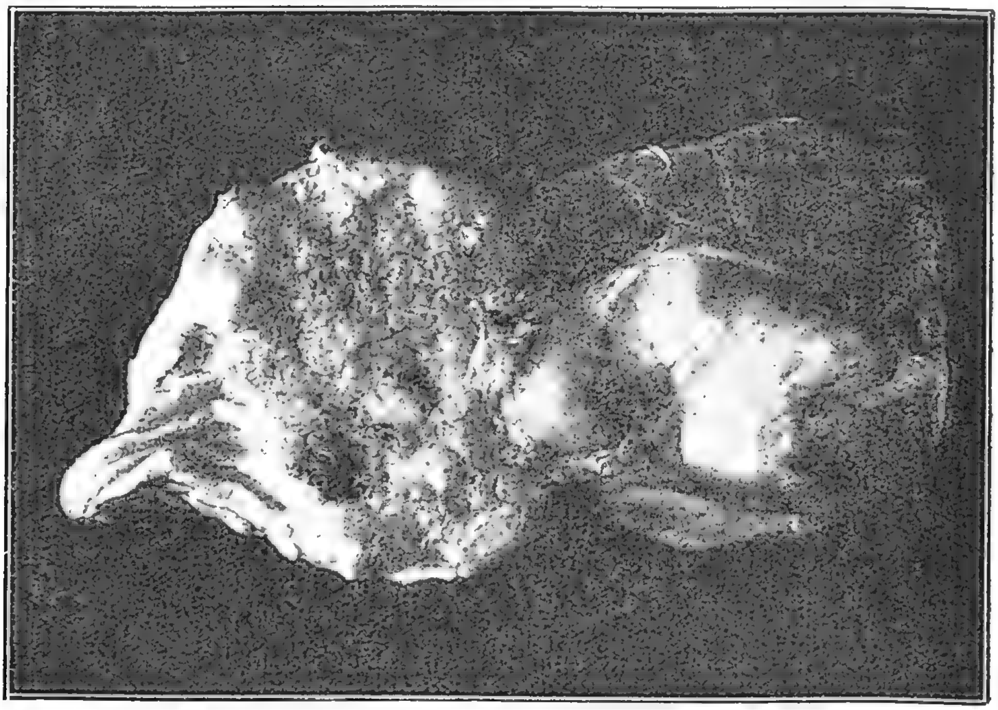


PLATE 106.

The Stomach of a Fowl (left) showing Worm Infestation. By looking closely the minute worms (life size) are easily discernible.

That portion of the digestive tract between the crop and gizzard is shown in Plate 106 heavily infested with worms. These worms were more or less encysted in the walls of the stomach, causing ulceration and eventually rupture.

In this plate the nodules caused by the gizzard worm are illustrated. On examination of the lining of the gizzard perforation will be noticed, and on removal of the lining the end of the worm will frequently be

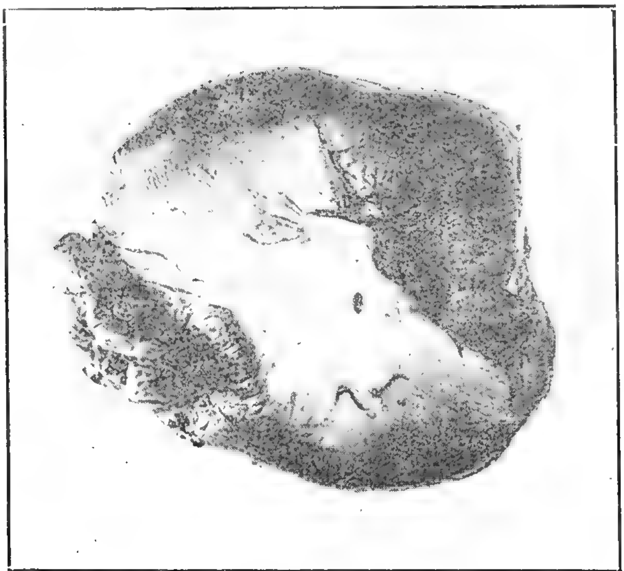


Plate 107.—The Gizzard of a Worm-infested Fowl.

seen protruding from the muscular tissue. They are difficult to extract complete and vary considerably in size.

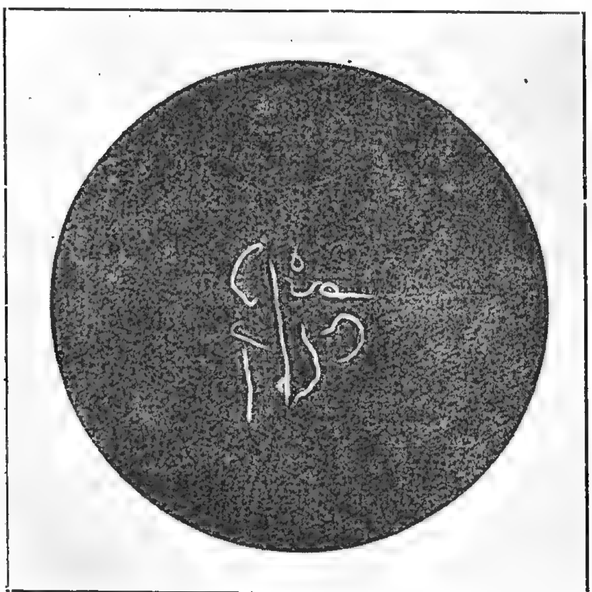


Plate 108.—Gizzard Worm (natural size).

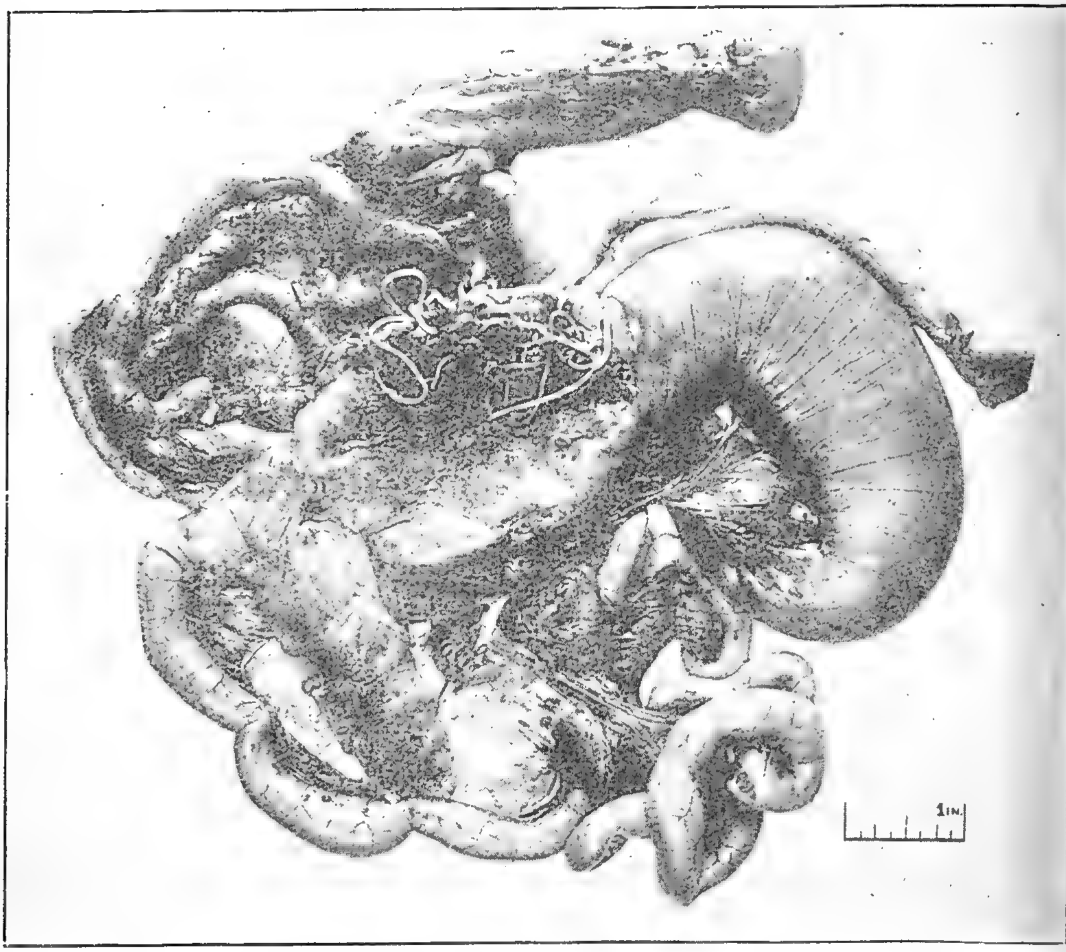


PLATE 109.

INTESTINE OF AUSTRALORP HEN WHICH DIED OF STOPPAGE DUE TO TUMOUR AND BALLING OF WORMS.

This plate illustrates possibly one of the most common of intestinal parasites met with in poultry, and also the harm ensuing on their unchecked multiplication. In all probability the tumourous growth was due to parasitical infestation.

Life History of Round Worms.

It is not intended in these notes to trace in detail the life history of the several round worms found in poultry—in fact, in many cases it is unknown—but it is proposed to deal briefly with those most frequently met with. The adult female worm lays its egg in the digestive tract, which is voided in the excreta. The egg is further developed in the soil, and subsequently enters the digestive tract of the fowl by adhering to particles of food picked up by it. In the digestive tract of the bird it completes its development. For the development of the embryo worm in the soil moisture is necessary, and that is why more general infestation is observed among poultry running in damp yards. After numerous post-mortem examinations, and a study of the environ-

mental and other conditions of the unthrifty flocks affected, one is forced to the conclusion that propagation of certain worms may occur in the infested host itself. A study of the illustration (Plate No. 109) supports this conclusion.

Preventive Methods to Avoid Infestation.

Having a general idea of the life history of round worms, what action can be taken to prevent general infestation? As worms are spread from bird to bird by eggs, infested stock should never be brought on to relatively clean premises. As the eggs occur in the excreta from infested stock, particular attention should be given to the regular cleaning-up of droppings; by doing so you not only assist in preventing the spread of worms, but preserve your fowl manure in its most valuable form. It is impossible to thoroughly cleanse the runs attached to poultry buildings, but they can be spaded over occasionally and, where other accommodation is available, allowed to remain unstocked for a

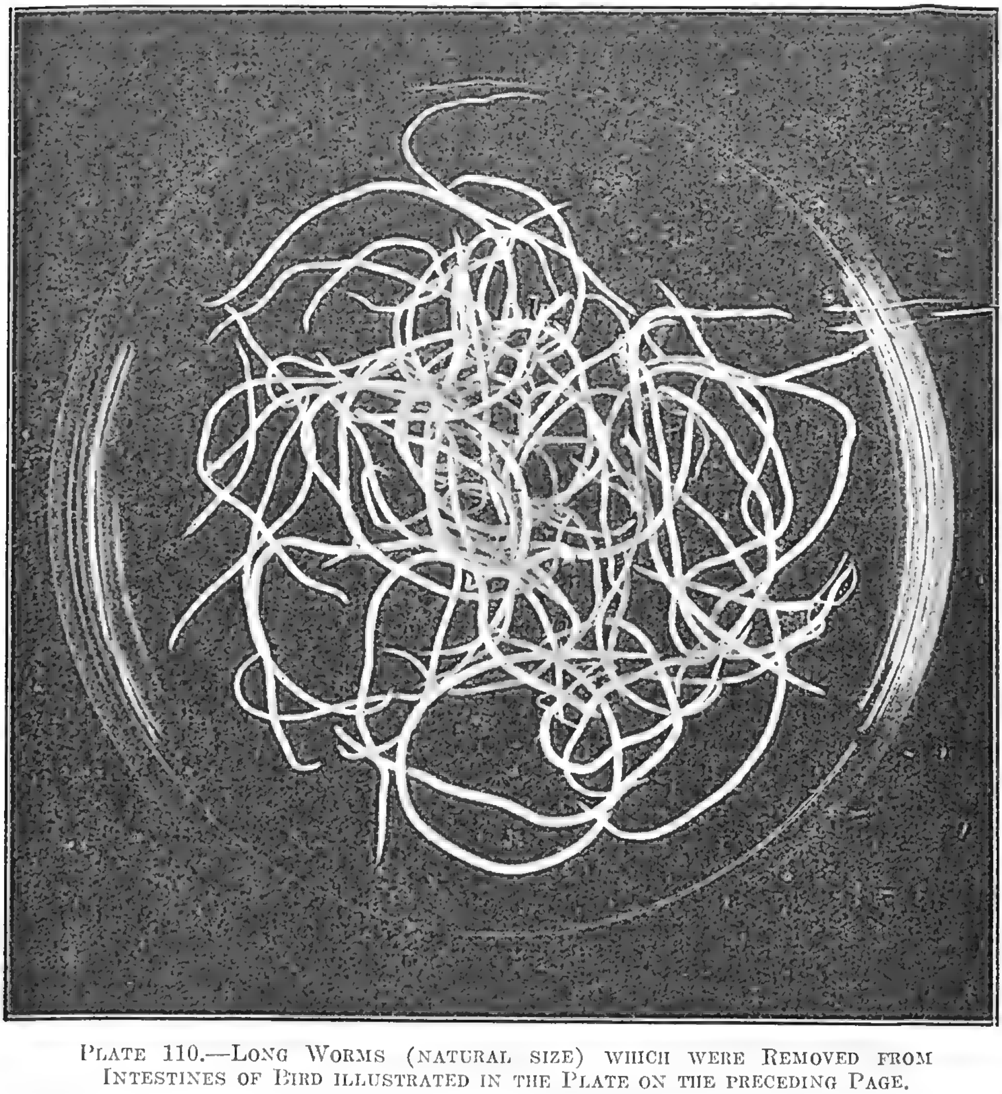


Plate 110.—Long Worms (natural size) which were Removed from Intestines of Bird illustrated in the Plate on the preceding Page.

reasonable quarantine period. The feeding of all mash foods, foods to which eggs would readily adhere, should be done in suitable containers, and where large numbers of birds are yarded several such containers should be provided to prevent portions of the mash from being spread about the yard.

Worm-infested stock are poor producers, and where infestation is severe the vitality of the birds is lowered, rendering them more susceptible to disease. Young chickens when hatched are of course free, and every effort should be made to maintain them in that condition, particularly during their growing stages. To do this they should be reared on ground which has not been fouled by adult stock. Do not make use of chicken-rearing pens, brooder-houses, &c., as temporary quarters for stock of any kind; by strictly adhering to this principle it is possible to place in the laying pens well developed stock that will give results. On the other hand, if growing stock become infested their growth is retarded and their vitality so lowered that they fall easy victims to diseases of an epizootic nature, such as roup and chicken pox, both of which are prevalent during the growing period and frequentl assume a more virulent form with this class of stock.

Diagnosis.

The symptoms which indicate the presence of worms are not very characteristic. The birds become dull, weak, emaciated, and sunken in face, losing all colour both in head and legs. The plumage loses its lustre and becomes roughened. Where infestation is not severe they are ravenous, but with the increase of worms their appetite diminishes, and they have no inclination to look for food. Their walk becomes stiff, and diarrhœa is often present. Generally birds infested with worms have the appearance of suffering from some chronic dsease.

Medicinal Treatment.

Too much reliance must not be placed on the ease with which worms can be expelled by medicaments, as the best are only partially effective. Therefore, it should be the aim of the producer to avoid infestation by every means in his power.

Many treatments could be recommended for individual birds, but the capsule method is the most convenient and, at the same time, very efficient. Worm capsules may be obtained in sizes according to the class of bird to be treated.

For flock treatment, tobacco dust at the rate of 2 per cent. in the mash has been found reasonably effective and economical. This quantity might be incorporated in the mash daily for a period of two weeks. After three to four weeks, the treatment might again be applied if worms are numerous. During the period of treatment Epsom salts at the rate of 1 oz. to each gallon of drinking water should be administered once a week, and again at the termination of treatment.

Tape Worms.

Heavy infestation of tape worms is not common, but, although this is so, producers should not lose sight of the fact that when such infestation does occur the consequence is serious. There are many species affecting poultry and there is a great variation in size. Some are so small that a hand lens is almost essential to distinguish them, while others may be found a foot or more in length.

To complete its life cycle, an intermediary host is necessary to the tape worm. One of the known hosts is the slug, another the fly, and another the earth worm.

The method of spread of the tapeworm is as follows:—The ripened segments of the worm are voided with the excreta. The intermediary host feeding upon the excreta where the tape worm eggs are present ingest the egg. The worm egg becomes encysted within the host, there undergoing a portion of its life cycle and completing it when the host is eaten by the birds.

The first line of attack is to remove the intermediary host, for without the host tape worm infestation could not ordinarily occur.

Strict sanitation materially assists in checking the number of worm eggs that are available for flies, slugs, &c., to feed on, and a fowlhouse regularly cleaned is not subject to heavy infestation of flies, while a yard free from rubbish and tufts of grass offers little harbourage for slugs.

Various treatments are recommended for freeing fowls of tape worms. Priority, however, is usually given to kamala. Kamala may be obtained in tabloid form and each bird may be treated individually, or the specific may be given in the mash at the rate of 15 grains per bird. Kamala is most unpleasant to handle, being very irritating, and any person who uses it for flock treatment should smear his hands and arms with grease before incorporating it in the mash. Farmers who have tried kamala in a wet mash state that birds do not relish their meal, and if the flock to be treated is not too large the tabloid form of treatment should be practised. It is certainly efficient and worth the labour entailed.

WEIGHT OF CREAM AND MILK.

What does a gallon of cream and a gallon of milk weigh? There is no legal weight for a given measure of cream or milk. It is generally accepted that a gallon of milk weighs 10.32 lb., and a gallon of cream testing 31.5 per cent. weighs 10 lb.

As the test of the cream increases, the weight per gallon decreases; for instance, 25 per cent. cream will weigh 10.073 lb. per gallon, a 30 per cent. cream will weigh 10.017 lb. per gallon, a 35 per cent. cream 9.963 lb. per gallon, and a 40 per cent. cream will weigh 9.908 lb. per gallon.

While the quantity of cream decreases in weight as the test increases, this is not so with whole milk as it is delivered from the cow. This is due to the fact that as normal milk increases in the percentage of fat, the specific gravity (weight per a given volume) also increases. Although the butter-fat in milk thus lowers the specific gravity of milk, the other solids tend to increase the specific gravity, as it must be understood that as the percentage of fat in milk increases, there is also an increase of solids other than fat, but not in the same ratio as the fat increases.

The milk solids not fat increase with a higher percentage of fat to offset the effect of the fat, with the result that, as the fat percentage of a given quantity of normal milk increases, its weight increases also.

This explanation applies to normal milk of high or low tests as it is delivered from the cow, but would not apply to milk whose butter-fat content has been increased by the addition of cream. Milk is sold to consumers by a measure and not by weight. This procedure is carried out as a matter of convenience and it is, generally speaking, equitable and just.

Chemistry in Agriculture.

By E. H. GURNEY, Agricultural Chemist.*

THE advancement of agriculture is dependent upon the application of scientific principles, and chemistry has been a factor of very great influence in agricultural progress.

Chemistry is very closely associated with all the operations which occur in animal and vegetable life; therefore, it will be seen there are many lines upon which the subject of chemistry in agriculture could be discussed, but on this occasion only very brief mention can be made of the chemistry of one or two agricultural processes.

Considering in the first place the maintaining of soil fertility, it should be said that research into this matter includes investigation of the soil's physical and biological conditions, as well as chemical conditions. In fact, soil research has become such an extensive and specialised matter that publications dealing only with the matter of soil research are in circulation, such as the publication "Soil Science." Study of these matters aid in understanding the fundamental facts of soil fertility.

Composition of Soil.

The chemical analysis of soil shows that it is composed of organic and inorganic (mineral) matter, and upon the analyses of plant life is found to be composed of organic and mineral matter. These mineral ingredients in plants are obtained from the soil water taken up by the roots of the plants. Most cultivated soils contain total amounts of the mineral elements required by plants sufficient for very many crops, but it is fortunate that only very little of this total amount is soluble in the soil water at any one time. If there is sufficient amount of mineral matter in soil water successful crops result—provided other soil conditions are favourable. This sufficiency or otherwise is well shown in the case of a soil on which successful crops cannot be obtained, but upon this soil, after the application of, say, 3 cwt. of superphosphate per acre containing only 70 lb. of soluble phosphoric acid, very successful crops are obtained.

In the analysis of soils, weak solutions of various chemical substances are used for the determination of available plant-food.

The acidity of soil has been well investigated by chemists, and quite a number of methods for its determination are available.

Soil Acidity.

The acidity of soil is of complex nature, but here it may briefly be said to comprise organic and mineral acidity. Organic acidity does not appear to have ill-effect upon plant life to the same extent as mineral acidity. Soil is also considered from its pH—that is, the degree of hydrogen ion concentration of the soil moisture.

Lime is used to rectify excessive soil acidity, but at times both lime and lime phosphate are used. Different plants are not affected in the same way by the application of lime to the soil; thus lucerne for its most successful growth requires a plentiful supply of lime, whereas it has been reported that peanuts are ill-affected by liming. It may be

* In a radio lecturette from Station 4QG.

mentioned here that, besides neutralising acidity, lime improves the mechanical condition of the soil.

The humus (decayed organic material) of soil has been subjected to very extensive chemical research. All the beneficial effects from the presence of humus in the soil cannot be stated now, but it should be said that the maintaining of sufficient supplies of humus in Queensland soils is one of the most important agricultural problems.

As is well known, farmyard manure supplies humus to the soil. Chemists have discovered means of preparing what may be called artificial or synthetic farmyard manure. The results of experiments conducted by Hutchinson and Richards at Rothamsted on the conversion of straw into a manure similar to farmyard manure were published in 1931, and further investigation has resulted in a patented process known under the name of "Adco." It is considered that ultimately the synthesis of humus from crude vegetable matter will be a matter of general practice.

Maintenance of Soil Fertility.

The application of artificial fertilizers is one means of maintaining soil fertility, and it is owing to chemical research that the present-day artificial fertilizers are in existence.

In 1842 Sir John Lawes took out a patent which covered the manufacture of superphosphate. The patent was based on the fact that when bone dust or rock sulphate was treated with sulphuric acid the insoluble phosphoric acid was converted into a soluble form. This may be taken as the initial step in the evolution of the present-day huge "artificial fertilizer" industry, and which has only been made possible by means of extensive chemical research.

Of the usual ingredients in artificial fertilizers nitrogen is of particular importance. Nitrogen exists in the proportion of about four-fifths in the atmosphere, but it is a very inert gas, and in the earlier days of the fertilizer industry there were no means of fixing the nitrogen of the air. But now chemists, with the assistance of engineers, have discovered several different methods by which nitrogen of the air can be made to combine with other elements on a commercial scale.

Briefly, some of these methods are the combination of nitrogen and oxygen at the very high temperature obtained by an electric arc, with the ultimate formation of nitric acid and then calcium or ammonium nitrate; the fixation of nitrogen by passing it over heated calcium carbide resulting in the formation of cyanamide (containing about 60 per cent. nitrolime); the treatment of calcium cyanamide to cause production of ammonia. Such processes as these have certainly lowered the price of nitrogenous fertilizers, but nitrogen is still the dearest fertilizing ingredient to buy.

Chemistry and Crop Production.

Chemistry has been applied to problems in connection with crop production, and the composition of healthy plant growth, as revealed by chemical analysis, indicates to a certain extent the amounts of plant-food required by such plant growth; but it must be remembered the composition of the plant varies at different stages of growth. The analysis of the ash of different crops shows that though the crops all contain practically the same mineral matter the proportion in which the different

elements are present may vary to a considerable extent. In the case of poor crops production, chemical investigation of the soil will frequently show the reason of crop failure.

Animal Nutrition.

In connection with animal nutrition, it may be said this is a matter entirely of chemical nature, for the food consumed by an animal is converted by chemical processes in the animal's body into substances capable of being assimilated by the animal. It will, therefore, be understood that it is only by chemical means that some knowledge has been gained concerning the nutrition of animals.

Analyses of very many of the foodstuffs of animals have been made showing the different nutrient ingredients contained in them. But this is not sufficient, as animals can digest more of some of these ingredients than others, and still further an ingredient in one food may be more easily digested than when contained in another foodstuff. This complication has been met by the chemist determining the digestibility of each nutrient ingredient in many foodstuffs. Briefly stated, the determining of the digestibility of a foodstuff is accomplished by analysing the solid excreted fæces produced from a known amount of foodstuff consumed. The digestibility of food determined in this way has been performed mostly by European and American investigators. The results obtained are termed "Digestibility co-efficients." The animal derives its energy from the food and a certain amount of this energy is required for mastication, digestion, &c., and this energy is deducted when the value of a food for production of milk, &c., is estimated.

It will be seen that animal nutrition is a complicated chemical process, and it is necessary when evaluing foodstuffs to have a means which will take into account these different requirements of the animal. Such terms as "Strach equivalent," "net energy," and "calories," denote the method by which the value of the food has been calculated.

Chemistry and Agricultural Progress.

Only a few items have been quoted as illustrating the assistance that the science of chemistry gives to agriculture, but brief mention will now be made of how chemistry assists agricultural advancement in being what may be termed a protective factor.

For the protection of the agriculturist the Governments have passed different Acts, such as the Fertilizers Act, the Stock Foods Act, the Pest Destroyers Act, and the Veterinary Medicines Act. These Acts provide that any commodity which is covered by any of these Acts must when sold have a label attached stating the composition of the material in so far as the active ingredients are concerned. Samples of material coming under these Acts are obtained by inspectors of the Department of Agriculture and forwarded for chemical analysis for the purpose of ascertaining if the samples are in accordance with the guarantee.

The buyer of material sold under these Acts may have it analysed, providing that the sample is taken and forwarded in accordance with the methods set out in the Act.

Seasonal Notes on the 1933-34 Cotton Crop.

R. W. PETERS, Cotton Experimentalist.

THE cotton season which is now approaching its final stage has been a peculiar one in several ways, and with its peculiarities new problems have resulted, the explanation of which in some cases is simple of interpretation, while in others further investigations are likely to be required, in that most unusually heavy winter rainfall was experienced in all districts except the southern. While this allowed of a welcome replacement of subsoil moisture following on three years of low rainfall, the preparation of the seed-beds was considerably handicapped, especially in the Callide Valley, where the showery conditions continued up to the normal planting time. The main cotton districts were, therefore, planted under most unusual conditions for Queensland, all the land being well soaked, with ample subsoil moisture, and in many cases ploughing was delayed by wet conditions.

General planting rains occurred by the end of September or early in October, and at frequent intervals from then on to the end of November, giving a wide range of time for planting and thus enabling late prepared seed-beds to be planted in good condition.

These conditions caused severe loss of stands in some districts, especially on clay slopes where heavy storm rains were responsible for the washing out of seeds, and in some instances, beating the soil surface so hard as to form a crust, thereby preventing germination.

The main problem confronting the average cotton farmer at this stage was that of weed control, the weeds coming up soon after the cotton rows appeared. The necessity of early cultivation so frequently advised by the Department of Agriculture and Stock was demonstrated in all districts to no small degree, and the results obtained by farmers who carried out this operation clearly illustrated the necessity and wisdom of early cultivation.

The practice recommended by the Cotton Section of the Department of Agriculture, as tested over a period of years at the Cotton Research Station, is to cultivate as soon as possible after the row of young plants is discernible, as this creates a mulch around them and destroys any young weed and grass growth. Riding cultivators, equipped with tines and fenders, are undoubtedly the most efficient implements to use for this operation, but cross harrowing can be substituted if the land is clean of trash, such as old corn stalks, &c.

This initial cultivation, if carried out properly, has a most important bearing on future operations. Not only is hoe work reduced to a minimum where early cultivation is done, but having the field well cultivated and clean early in the season lessens the cost of thinning and the number of cultivations required to grow the crop successfully. Where the fields are cleaned early the usual dry weather at that time kills any uprooted weeds and grass seedlings, and a field in such condition can experience a fairly prolonged wet period without weed growth becoming excessive enough to affect cotton plants. A cultivation made at the first opportunity after any period of prolonged rains then easily controls the tender

weed growth and leaves the field in good condition. Undoubtedly cultivating as soon as the cotton plants are 2 to 3 inches high has a most important bearing on the cost of production and the yields realised, and growers should pay greater attention to carrying out this operation.

Conditions for successful cotton growing continued generally in all the main areas until after the early January rains when hot dry weather prevailed.

In the Southern and South Burnett areas many cotton crops suffered through growers not cultivating immediately after this rain. In some instances this was due to the farmers being engaged in lucerne harvesting, while in others it was thought that the plants were too high to cultivate. The omission of this cultivation has proved to be expensive in most instances, for a hard crust set in the following hot dry period, which not only checked the development of the plants but later allowed the soil to crack badly and thus lose a lot of moisture. Growers must realise that the maintenance of a mulch as long as possible is necessary in the cotton crops. The best soils for cotton production appear to be the clay loams, and where crusts set on these before the plants are so tall as to provide sufficient shade, excessive loss of moisture occurs. Cultivation can be maintained in very tall cotton if done with a walking scuffler drawn by one horse harnessed with long traces and a short spreader. Undoubtedly cultivation should be continued much later than is done by many farmers, especially those on clay loam slopes.

Had the cultivation referred to been carried out, thereby loosening the soil crust, the rapid evaporation of the soil moisture would have been lessened to such an extent that ample moisture would have been available for the roots to absorb a sufficient supply to meet its transpiration requirements.

It is interesting to note this season that cotton planted at the end of September or quite early in October suffered by far the heavier shedding of crop during January, whereas cotton planted later, from the middle of October, suffered relatively little shedding. The probable explanation is that the earlier planted cotton apparently suffered through setting a heavy early crop which proved too great a load for the plant to hold. In the case of mid-October plantings, these were not advanced to such a stage, and were able to withstand more effectively the hot dry period.

It would appear from this that mid-October plantings may be more advisable in most districts, as this procedure would tend to lessen the load of forms that the plants would have to carry during the usual stress conditions in January, and would also delay the opening of the lower bolls until after February, which is often a very wet month.

Picking conditions are generally ideal during March and the rest of the autumn, so that higher grades would be obtained with the later planted cotton.

Similar observations were made in the United States of America a few years ago, where it was found that varieties which set the quickest crop of forms did not produce the heaviest crop. In other words, varieties which put on forms moderately early, but at the same time somewhat sparingly, so that there was a gradual accumulation rather than a rapid setting of crop, finally produced more cotton.

Diseases and Insect Pests.

Diseases and insect pests have not been responsible for any very serious loss this season. At the commencement cutworms caused damage to the young seedlings only in isolated areas, and in many cases these were controlled by the paris green poison bait.

Terminal loss was in evidence again in most areas, and was probably caused by thrips, which destroy the terminal buds by sucking, forcing the plant to send out numerous vegetative branches and causing a bushy growth.

Cotton stainers have been scarce throughout the season with the exception of the false cotton stainer. This has been present in most fields throughout the season, and has in all probability been responsible for a considerable amount of shedding at different periods prior to the dry spell in January.

The corn-ear worm attacked cotton formations during January to varying degrees, and in the Southern area appears to have done considerable damage, probably assisted by a pest somewhat similar in its habits, the rough boll worm.

The only disease manifesting itself to any extent has been the angular leaf spot, which always makes its appearance after rain and has, therefore, under this season's conditions, been expected.

Crop Prospects.

Following the recent beneficial rains which were so urgently needed over the whole of the cotton belt to assist the development of the top crop, it appears probable that a record crop will be harvested. The quality of the crop, provided suitable harvesting conditions prevail, should show a marked improvement over that of the crops of recent seasons, when droughty conditions were experienced generally. It is to be hoped that a crop in keeping with the present prospective yield will be obtained. Not only would the financial condition of a large number of farmers be greatly improved, but a marked relief of unemployment would be afforded through the harvesting, preparation, and marketing of the crop and, in addition to this, a sum totalling several hundred thousand pounds would be distributed in the State from the realisation of the sale of the crop.

Cotton Growing on New Cultivations.

By W. G. WELLS, Director of Cotton Culture.

THE present phase of cotton growing in Queensland has now extended over roughly twelve seasons, which has been sufficient time to demonstrate the existence of several factors operating here in cotton growing, amongst which is the beneficial result that is obtained from growing this crop on land newly brought under cultivation. In the earlier years of this phase it was thought that cotton could be grown successfully on nearly any kind of soil, but the disastrous results obtained by many unfortunate farmers clearly demonstrated in most of the older cultivated areas a marked limitation of soil types having a high degree of suitability for producing profitable yields under a range of climatic conditions.

Better results were obtained generally in the districts of newer settlements, however, especially in the Upper Burnett-Callide Valley scheme, where cattle stations were opened for selection as agricultural farms in 1924. Demonstration areas had shown that cotton growing was eminently suitable for the general district, and the new settlers mostly concentrated on this crop. During the first few seasons good to excellent yields were obtained, as much as 1,900 to 2,000 lb. seed cotton being realised per acre. Owing to limited capital and the cost of clearing the heavily timbered alluvial country, cotton was grown continuously for several years on the same land, and after a few seasons it became clearly evident that the yields were declining on most of the soils. Less favourable seasons and insect attacks were at first thought to be responsible, but examinations of the soils indicated that changes occurring in their physical and chemical composition were the contributory causes, although the seasonal conditions and insect attacks were the direct agents.

Nitrate Content of Soils.

It was at first thought that the increasing of the nitrate content of the soil with each season's cultivation was the explanation of the rank growth being obtained. These growths were generally attacked by the corn-ear worm to such an extent that little or often no crop was produced. Examinations of some soils showed that the nitrate content in the initial determinations, expressed in parts per million parts of soil, ranged from 7 to 15 parts in new cultivations to 30 and 40 parts in six or seven-year old cultivations. As nitrogen is the plant-food which is necessary to promote good growth of plants, it can be appreciated how the marked increase in nitrates would tend to stimulate rank growth on the richer alluvials.

It was also ascertained that the carbon content of the older alluvial cultivations was being lowered with the continuous cultivation. Carbon is the basic material of all organic matter, such as roots and parts of plants, grasses, &c., so that the depletion of the carbon and the increase of the nitrogen content brought about a lowering in the ratio of carbon and nitrogen. This ratio is a very important factor in promoting the growth and fruiting of a cotton plant, and as the ratio apparently lessened in some soils by as much as 40 per cent., the effect on the soils of the continuous cultivation can be understood.

Effect of Carbon-Nitrogen Ratio.

The effect of this change in the carbon-nitrogen ratio of the soils and the increase of the nitrate content is to make the plants grow rankish with a light amount of fruiting during wet periods. These periods frequently coincide with the occurrence of large populations of corn-ear worm moths, which often find the tender rank growth of the cotton plants attractive places on which to lay their eggs. The resultant broods of young corn-ear worms rapidly destroy first, the young squares, and then later the young and even nearly matured bolls during the latter stages of the life of the grubs. With the removal of the load of squares and small bolls, the plants on the soils with higher nitrate content and low carbon-nitrogen ratio tend to make very rapid development of rank vegetative growth, which becomes all the more attractive to insects later in the season, and often no yields are harvested.

Examinations of crops on new cultivations adjacent to old ones have shown that the plants on the new cultivations can be attacked fairly heavily by corn-ear worm and other pests causing similar damage, and yet good yields can eventually be obtained. Apparently on such crops the proper carbon-nitrogen ratio and the nitrate content of the soils prevent rank growth, and as soon as the attack is over, if climatic conditions are at all favourable, the formation of squares is quickly started and a profitable load of fruit is soon developing, especially where a variety with the ability to produce a heavy top crop is being grown. This phenomenon has been observed many times in all the cotton-growing districts over a series of seasons, so that it undoubtedly pays better to grow cotton on the newer cultivations than on the old ones, particularly on the alluvial heavy loams and clay loams.

The following results, obtained at the Cotton Research Station in the Callide Valley, illustrate very well the gains which may be realised by planting on new cultivations on the more fertile loams:—

	Series J.	Series K.
Average yield in lb. seed cotton per acre from one-year old cultivation	917	1,171
Average yield in lb. seed cotton per acre from four-year old cultivation	501	475
Average yield in lb. seed cotton per acre from eight-year old cultivation	251	436
Gain in favour of new as compared to eight-year old cultivation	666	735
Gain in favour of new as compared to four-year old cultivation	416	696

It will be seen that a heavy decline in the yielding ability of the soil occurred with four years of continuous cultivation of cotton.

Moisture Penetration.

Soil moisture studies made at the Cotton Research Station have thrown further light on the problem of why the cotton crops produce heavier on the new than on the old cultivations. In the 1932-33 season it was ascertained that a fall of 2·94 inches—occurring in two storms, one late in the evening followed by the other early next morning—failed to increase the soil moisture content at the 4 to 6-inch level on well-mulched old cultivation to any appreciable extent. An experiment in the following season, in which the rate of penetration was studied of a

continuous rain yielding 2·46 inches and lasting over twenty-five hours, established the fact that only 35 per cent. of the rain penetrated into the first 18 inches of soil in the old cultivation, as compared to 74 per cent. in the new. Studies made at the Missouri State Station, in the United States of America, have likewise shown a marked difference in the run-off of rains in favour of the more open soils or soils cropped with grasses, cereals, &c.

It would appear, therefore, that greater penetration of rains, especially beating severe storms, will be obtained in the newer cultivations. This is probably another explanation of why heavier yields of cotton are produced on the new cultivations, for with the better and quicker penetration that occurs in such soils there will be a greater washing down of the soluble nitrate, and thus there will be less of them available for the upper root system of the plants while the soils in this area are thoroughly moist. As the greater proportion of the lateral root systems of cotton plants on most of the best cotton soils in Queensland, which are of a heavy clay loam nature, occur in the first foot of soils, the lessening of the nitrates in this area must help materially in controlling plant growth during wet periods.

It is recommended, therefore, that cotton be grown only a few seasons in succession on new cultivations, and then a fresh area of suitable soil be prepared. The most suitable and unsuitable soils for growing cotton in Queensland have already been described in "Cotton Growing," a copy of which may be obtained from the Department of Agriculture and Stock, Brisbane.

Methods of Improving Soils.

It is obvious that on most farms the bringing in of new cultivation for cotton growing cannot be continued for many years, owing to limitation of area. Rotation of crops must, therefore, be practised. A wide range of studies of the suitability of various crop rotations have, therefore, been instituted at the Cotton Research Station to ascertain if it is possible to obtain the same results by growing cotton in rotation with other crops as are realised on new cultivations. Some gains have been obtained through following maize, panicum, and also two cereals, such as wheat followed by maize, especially when the cotton crops have been grown in dry seasons and the cereals in wet ones. Likewise, following fallow has proved beneficial in dry seasons. No results have been secured, however, which would indicate that any of the rotations of cotton and ordinary farm crops will give, over a series of seasons, yields comparable to those usually obtained when cotton is planted on new cultivations.

The good yields of cotton which are generally produced, when brigalow scrub clay loams are stumped, following several years of Rhodes grass, have led to extensive studies being carried out at the Research Station of the possibilities of using Rhodes grass to reduce the nitrate content of the old cultivations sufficiently to reproduce the results that are obtained during the first few seasons of cotton growing on new cultivations. These have not been in progress long enough to allow of definite conclusions being made, except that soil analyses have shown a substantial reduction in nitrates is obtained after two years' growth of Rhodes grass. Instances have been seen, however, in other districts, where cotton following several years of Rhodes grass on rich brigalow clay loams, has produced good yields, although all other cotton fields in the same immediate area have had their yields seriously

reduced through corn-ear worm attacks, which is a common experience on the old cultivations of these districts. In such areas maize, during the first two crops following Rhodes grass of several seasons' growth shows every evidence of a lack of nitrates. With further seasons of cultivation this condition changes and good yields are obtained.

It would appear, therefore, that a Rhodes grass-cotton rotation may be the logical way to overcome the problem that confronts the cotton growers on the older cultivations. This grass is an excellent pasturage for dairy cows, and would, therefore, be valuable to the average cotton growers who also engage in dairying to an appreciable extent. A field of old cotton cultivation could be sown to Rhodes grass and left for three or four years and then planted to cotton for three seasons, when it could be resown with Rhodes grass. Such a rotation would be cheaper and require less labour than where fodder crops are resown annually, and in addition, both excellent pasturage and hay of high-feed value could be obtained.

Rhodes Grass Suitable for Forest Soils.

The idea prevailing in most districts that Rhodes grass does not do well on forest soils has not been borne out at the Research Station. An 11-acre field of very droughty sandy clay forest soil, where summer-grown crops produced very low yields, has given excellent pasturage for seven years to as many as fourteen heavy draught horses a season, through proper rotational grazing.

No difficulty need be feared regarding the controlling of the Rhodes grass seedlings during the first season of cotton cultivation. It has been found at the Research Station that two ploughings with a thorough harrowing after the planting rain prior to sowing the cotton, and then cultivating as soon as the rows of cotton are discernible, allows of easy controlling of future growth, if ordinary practices of good cultivation are followed.

Time of Breaking-up New Cultivations.

It is recommended that the first ploughing of the new cultivation, or of the Rhodes grass on old cultivation, be done prior to the June rains if possible. This will allow of a good penetration to the lower subsoils being obtained which will be of advantage during later dry periods. Experiments at the Research Station have demonstrated that a gain in moisture, equivalent to at least 1 inch of rain, has been obtained in the first 18 inches of soil by ploughing before the June rains. This additional moisture not only has maintained good growth of the cotton plants during adverse periods, but has actually saved the crop under drought conditions in the early stages of growth. A cross-ploughing after the June rains will then leave the soil in excellent condition for preparing a firm, moist seed-bed.

Rate of Planting on New Cultivations.

Owing to the more open type of surface of the seed-bed in the new cultivations, or in fact following Rhodes grass and any fodder crop, it is advisable to plant cotton at a heavier rate than is satisfactory on old cotton cultivations. Experiments have demonstrated that when planting under favourable conditions at a rate of 15 lb. per acre of delinted seed, in rows 4½ feet apart, an appreciable gain in number of seedlings per foot of row can be obtained in favour of the old cultivation. Under conditions of light planting rains an even greater difference may result.

Conclusions.

Cotton growing has been carried out long enough in most of the main cotton-growing districts of this State to develop problems, amongst which is the low yield often produced on the older cultivations. Good and excellent yields are obtained on soils freshly brought under cultivation in these areas, but with continuous cotton growing the yields decline seriously. Rotations with the various fodder and grain crops that can be grown in most of the cotton-growing districts, while indicating some improvement in yields can be obtained, especially in dry seasons, have failed to produce the differences in yields that usually result where cotton crops on old and new cultivations are compared. Results secured by farmers in different districts indicate that a rotation of three or four years of Rhodes grass followed by, say, three cotton crops, may prove to be the most profitable rotation that the farmer who grows cotton and engages in dairying can follow. It is recommended, therefore, that every grower test out the suitability of this practice to his soils. One thing is certain, however, if this rotation is not suitable other ones should be tried, for the continuous growing of cotton on the same land will not yield the maximum return it is possible to obtain on most soils.

FARM TRAINING.

Following is a reprint of a leading article in the Brisbane "Courier-Mail," 12th March, 1934:—

Not only in Queensland but throughout the whole world the agricultural industry is in an intensely serious position. Among the industrial population of the towns there is a popular belief that farmers are by nature, and almost by profession, confirmed grumblers. Possibly there is some truth in the statement, as many of them would admit. Unquestionably, however, the farmers are facing to-day the full force of the blizzard of depression which has been sweeping throughout the world, and it has struck them just as other sections of the community are beginning to emerge from it. The wheatmen, the dairymen, the fruitgrowers, the poultry-breeders, and even the market gardeners are getting for their produce less than its cost of production. This is due not to any local cause, but to the tragic fall in prices in the markets of the world, and the effect is being felt by farmers in every country. In France, within the last two months, millions of bushels of surplus wheat have been fed to stock; and, as suggested in the "Courier-Mail" a few days ago, it may be a good deal better for local farmers to feed their surplus wheat to stock and to poultry than to sell it at a ruinous price in London. The position of the dairymen and the fruitgrowers is equally precarious, and likely to remain so until the nations of the world realise that they must drop their intense nationalism and adopt a policy of trading co-operation.

Queensland is an essentially pastoral and agricultural community, and we cannot afford to be pessimistic about those industries because they are going through a world depression which, let us hope, is coming to an end. As the Minister for Agriculture said in an article in the "Courier-Mail" last Saturday, if we were to admit that the limits of production had been reached there would be no hope for Queensland or for Australia. Queensland's future depends upon the development of its pastoral and agricultural industries, wisely controlled and administered. It would be well if farmers would accept as a sincere statement of fact the assurance that the Government is endeavouring to assist them in every possible way, and that in training lads for agriculture it is thinking of the future. No good service could be gained by ignoring the seriousness of the present position, but it would be a policy of sheer despair to neglect the future or to discontinue the training of farm lads. As Mr. Bulcock said in his article on Saturday, the time has gone when the farmer was a "way-back"; he must now be a trained man, combining practical and scientific knowledge. For such men, despite the present position, there is an immense future.

New Director of Fruit Culture.

MR BARNES' CAREER.

MR. HARRY BARNES, Instructor in Fruit Culture, has been appointed Director of Fruit Culture in the Department of Agriculture and Stock, in succession to the late Mr. George Williams.

The new chief of the Fruit Branch was born in Maryborough, Queensland, in 1904, and was educated at the Christian Brothers High School in that city. After passing the Junior University examination he received an appointment in 1920 to the Department of Agriculture and Stock, and gained administrative experience in different branches of the Department. For two years in succession he served with the Central

PLATE 111.—MR. H. BARNES, DIRECTOR OF FRUIT CULTURE, WHO HAS SUCCEEDED THE LATE MR. GEORGE WILLIAMS.

Sugar Cane Prices Board, accompanying the Board on its annual tours of duty throughout the canegrowing districts of the State. In 1924 he was transferred to the Fruit Branch to perform secretarial duties for the then Director of Fruit Culture, the late Mr. A. H. Benson, M.R.A.C., and was subsequently appointed secretary of the Committee of Investigation into the bunchy top disease of bananas.

In 1926, Mr. Barnes passed the Fruit Inspectors' examination, in which he secured first place; and in 1929 he passed the Fruit Instructors' examination. During the last three years he has been associated with the direction of his branch of the Department; and for the past year he has been carrying out the duties of Director of Fruit Culture in an acting capacity. On his recommendation the following schemes and experiments have been put in hand by the Department:—A citrus budwood scheme designed to improve the standard of the citrus fruits produced in the State. Regulations for the better control of banana diseases (such as bunchy top and beetle borer), and for the more efficient control of fruit fly in deciduous fruits. The inauguration of maturity standards for citrus fruits and grapes. The conduct of experiments to ascertain the relative merits of muriate and sulphate of potash when applied to pineapples. The establishment of a citrus fertilizer plot, for the purpose of bringing about an increase in the bearing capacity of low-bearing trees. The establishment of a Queensland Nut experiment plot at St. Lucia. Experiments with the object of determining the most suitable stocks for citrus trees in the various soils in different districts. Experiments with dates and olives in Western Queensland. Experiments to determine the storage life of lemons.

In addition to gaining a wide knowledge of field practice and problems, Mr. Barnes has pursued a course of study bearing on the scientific side of fruit culture at the Queensland University; and has also, as chairman of the Banana Industry Protection Board and deputy for the Director of Marketing on the Committee of Direction of Fruit Marketing, gained a sound knowledge of the economics of the industry.

TO FAIL AT DAIRYING.

There is a variety of practices conducive to failure at dairying. The following were enumerated in an American paper some years ago, but they may still be relied on:—

Buy any old cow, so long as it is a cow.

Buy the cheapest food, if any, regardless of its content.

Be careful not to test—your grandfather got along without it.

If the cows don't move smartly, prod them with a fork or milk stool—it brightens the animals up.

Milk and feed the cows when the notion strikes you or let them go over one milking; there is nothing in regularity.

Breed your cows to any sort of scrub bull, no matter of what breed, so long as they will freshen once a year or so.

Use luke-warm or cold water for washing dairy utensils (if you must wash them)—it is less hurtful to the germs that lower the quality of dairy products.

On no account wash your hands whilst milking—detrimental bacteria like dirt.

Persevere with these methods—you can depend upon them breaking you in the end.

Strawberry Culture.

Revised by H. BARNES, Director of Fruit Culture.

ALTHOUGH the strawberry is commonly considered to be better adapted to the climate of the temperate zones than to that of the semi-tropics, it is, nevertheless, the one berry fruit which can be grown to perfection in this State. Excellent fruit is produced in our Southern coastal districts and even under tropical conditions such as those existing at Townsville, when the plants are grown on alluvial soil and are well irrigated, very good fruit is produced. This shows that the strawberry has a wide range in this State and that it can be grown successfully over the greater portion of our Eastern coastline and the tableland country adjacent thereto, provided there is either an adequate rainfall or, failing that, a supply of water for irrigation.

The commercial cultivation of the strawberry is, however, confined mainly to those districts possessing a regular rainfall, and extends from the Redlands Area in the south to Bundaberg in the north. When grown under suitable conditions in this district, the strawberry has proved itself to be an early and prolific bearer, able to stand a fair amount of hardship, in the shape of dry weather, and to resist the attack of insect and fungus pests to a greater or less extent.

There is a good demand for the fruit, either for immediate consumption in this and the Southern States or for conversion into jam, and, as few crops yield a quicker return, it frequently enables a beginner to make a living whilst more slowly maturing fruit crops are coming into bearing.

Our strawberries are of excellent quality and carry well, so that they reach their destination in the Southern States in good order when carefully handled and packed, provided the weather is not excessively warm or the fruit over-soft on account of excessive rainfall. The fruit is very suitable for jam, and the product of some of our local factories is not excelled elsewhere in the Commonwealth.

Soils for Strawberries.

Given suitable climatic conditions, strawberries will thrive in most soils, but the ideal soil for this fruit is a rich loam of medium texture, well supplied with humus, possessing perfect natural drainage, and capable of retaining moisture during dry spells—and the nearer one can get the soil to this ideal the better the results. Heavy, cold, badly-drained soils are not suitable, but any good loam or sandy loam, whether of scrub or forest origin, can be made to produce good berries if properly treated.

Preparation of the Soil.

There is only one way to prepare soil for strawberry culture, and that is—*thoroughly*. Nothing else will do. In the case of virgin scrub or forest land, which is, as a rule, fairly rich in humus, the land, after it is cleared, should be broken up deeply and brought into a state of as nearly perfect tilth as possible. On virgin soil, except it is of the poorest nature, it is not necessary to apply any manure for the first crop, as there is usually an ample supply of available plant-food and humus present in such soil, but for subsequent crops, or old land, systematic manuring is very important. Old land that is at all deficient in humus should have that deficiency made good, either by the application of a heavy dressing of farmyard or stable manure, such as a load to every

4 perches, or if this cannot be obtained, then by growing a green crop such as cowpea or other legume which has been well manured with phosphatic and potassic manures and ploughing it in. The green crop so ploughed in should be allowed to rot and, when rotten, the land should be reploughed and worked down fine. If the green crop has received a generous dressing of phosphatic and potassic manure, then there will be no need to apply any further fertilizing material to the land, as a complete manuring has been given; but if not, then the soil should be treated as recommended later on.

The surface of the land should be kept as even and level as possible, and, as already stated, it should be worked down fine, so that when the young plants are set out they will take hold of the soil at once and become firmly established.

Planting strawberries on raw land, sour land, or land that has been indifferently prepared is only courting failure, whereas, when the planting is carried out as advised, there is every chance of success.

Selection of Plants.

Always obtain strong runners from healthy, prolific plants. The first runners next to the parent plants are to be preferred, as they are usually the most vigorous and best rooted, and, further, they come into bearing earlier; but, failing these, well-rooted, strong, well-grown runners from nearer the tips can be used, and although they will not fruit as soon as the first runners they will give a good yield later on, and frequently continue to bear when the earlier fruiting plants have ceased.

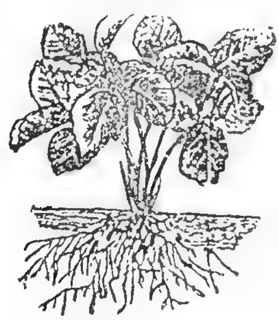
Planting.

March and April are the main planting months. Having secured suitable plants trim the roots with a sharp knife to about 3 to 4 inches long, taking care not to let them dry out. Spread the roots evenly when planting and leave the crown of the plant just above the level of the ground. In the following illustrations No. 1 shows a plant set too

No. 1.

No. 2.

No. 3.



No. 4.

PLATE 112.

deeply; in No. 2 the roots are all bunched together so that the plant has not got a firm hold on the ground. No. 3 has been planted too high, whilst No. 4 illustrates the correct depth at which to plant and the manner of spreading the roots.

Plants are usually set with the hand or with the aid of a trowel or dibble. A planting wire is useful aid in keeping the rows straight.

Careless planting is responsible for many failures, especially too deep planting, as no strawberry will thrive if its crown is buried under the soil.

The distance at which to set out the plants varies somewhat in different districts, but it is not advisable in any case to overcrowd them, but to allow plenty of room; 20 inches to 2 feet apart each way is a favourite distance, so that the land can be worked all round the plants, or if row planting is desired, then the rows should be about 30 inches apart and plants set out at from 15 to 18 inches apart in the row. The illustration of a strawberry garden shows the manner of planting adopted by a most successful grower, and it will be noted that the plants have plenty of room and are in no way overcrowded.

Cultivation.

Strawberry plants must only be surface-worked whilst growing or bearing fruit. The object is to keep down weed growth and to prevent the surface of the soil caking; but the cultivation must never be so deep that it will injure the roots. The best implement to use is the Planet Junior hand cultivator or similar machine; or, failing that, a good Dutch hoe of any type that may be preferred.

Weed growth must be kept down and the surface of the soil must not be allowed to become hard and set, as if it does the evaporation of moisture from the soil will be greatly increased, and it will dry out rapidly.

If the plants are to be kept over for a second or third year, then the whole of the runners, other than those required to make good any losses in the original plants, must be removed throughout the season, and the ground between the original plants must be well broken up and manured in late summer or early autumn, so that the plants will be in good heart for producing a crop of fruit the following season.

If the plants have been badly attacked by leaf blight it is a good plan to cut off all the leaves and burn them prior to working and manuring the land, as numerous fungus spores are destroyed thereby. The burning off is best done by scattering a little loose dry straw over the plants when the leaves have been cut off and have dried, and then setting fire to the lot. A light burning does not injure the plants, but is decidedly beneficial.

Mulching.

Mulching is seldom practised in this State, probably owing to the fact that a really good material for mulching is not readily obtainable, and therefore a light soil mulch produced by the surface working of the soil by means of a Dutch hoe, Planet Junior, or similar hand cultivator is all that is necessary. The use of a paper mulch has, however, much to recommend it, as it would certainly keep down weed growth and tend to maintain even soil conditions. A strip of paper mulch 18 inches wide

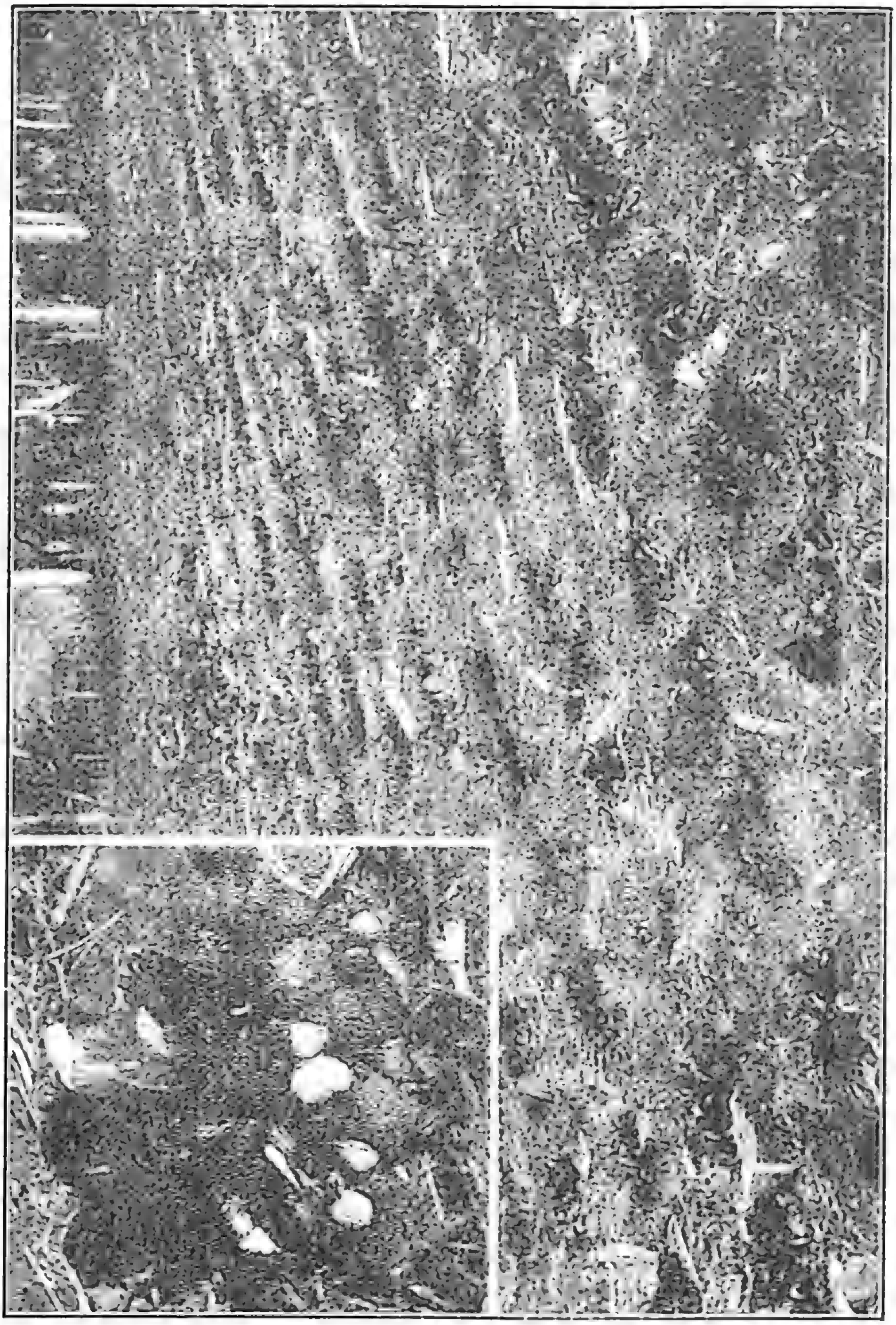


PLATE 113.—A STRAWBERRY GARDEN ON THE NEAR NORTH COAST.

would be all that is necessary, and the plants should be set through the paper at from 15 to 18 inches apart in the row. A further advantage to be derived by the use of paper mulch is that the fruit would be kept much cleaner, as it would not be so liable to be covered with dirt as frequently happens if heavy rain falls or the watering is not very carefully applied. Some growers use dry grass or straw as a mulch and this practice is also considered a good one.

Irrigation.

Where water is obtainable it should always be available for the plants' use during dry weather, as the ability to maintain an adequate supply of moisture in the soil at all times and thus maintain an even growth will result in larger and better fruit, and a heavy increase in yield. Strawberries pay well for intensive culture, and the money expended in providing a good system of overhead or other method of spray irrigation will be found to be a very profitable investment. A combination of mulching and spray irrigation will enable a grower to maintain a regular supply throughout the season of first-class table fruit.

Manuring.

The strawberry is a fruit that requires an abundance of readily available plant-food, and one that pays well for systematic and judicious manuring. In the 1931 edition of his pamphlet, "Complete Fertilizers for Farm and Orchard," the late Agricultural Chemist to this Department (Mr. J. C. Brünnich) gives the following advice, which it will pay to follow:—

"Some of our coastal country, between the 26th and 28th degrees south latitude, is particularly suitable for strawberry culture, frequently producing quite phenomenal crops. Some of our rich loamy soils found in our coastal scrub lands give the best results. In poorer sandy soils the improvement effected by artificial fertilizers, particularly such containing potash, is very marked, and a light dressing of 5 to 10 tons of stable manure per acre is very beneficial.

"A complete fertilizer for strawberries of the formula 4-8-10 should be used at the rate of 5 to 9 cwt. per acre.

"The following fertilizer mixture may be found useful:—

1 to 1½ cwt. sulphate of ammonia, or nitrate of soda 3 to 5 cwt. basic or ordinary superphosphate 1½ to 2 cwt. sulphate of potash	per acre;

or,

1½ to 2 cwt. nitrate of soda 1 cwt. fine bonemeal 4 cwt. superphosphate or Nauru phosphate 2 cwt. sulphate of potash	per acre;

The latter applied by two or three top-dressings, at the rate of 1 cwt. per acre, when fruit is first forming, and thereafter at intervals of two weeks."

Green Crop Manuring.

When dealing with the preparation of the soil, the importance of providing an adequate supply of humus was referred to, and the statement made that where a sufficient quantity of farmyard manure was not

available to supply this essential ingredient to the soil, green crop manuring should be used to make good the deficiency. Humus plays a very important part in the composition of soils, and especially so in those devoted to strawberry culture, as its presence in the soil enables it to retain a much larger percentage of moisture than it would do were it deficient in humus. The power to retain moisture is of the greatest importance in a soil devoted to strawberry culture, as the strawberry is a shallow-rooted plant that soon suffers when there is any lack of moisture.

Moisture in the soil also enables the artificial fertilizers applied to become available, as they are of no use whatever to the crop unless their plant-food is capable of being dissolved by the soil moisture, and can thus be obtained therefrom by the roots of plants. When leguminous crops are grown as a green manure they should be manured with a fertilizer containing lime, citrate-soluble phosphoric acid, and potash; such as a mixture of finely-ground island phosphate and a potash salt, used in the proportion of four of the former to one of the latter. No nitrogen need be applied, as the plants will obtain their own from the atmosphere; and when they are ploughed into the soil it will not only be enriched by the plant-foods contained in the fertilizer applied to the soil to produce the green crop, but also by the nitrogen that has been produced by the green crop itself; the whole forming a complete fertilizer, as it contains all the essential plant-foods in an available form. Green crop manuring is the cheapest way in which to apply nitrogen to the soil, so that, taking into consideration its value as a supplier of humus, it is of the greatest value when intensive cultivation is intended; and as the strawberry is a crop that demands intensive cultivation, its importance cannot be over-estimated, especially in soils that are deficient in humus. Cowpeas, Poona peas, vetch beans, small Mauritius beans, and the large black Mauritius beans are the best legumes for summer growth and vetches or tares and the grey or partridge field pea for winter.

Marketing.

Fruit for immediate consumption should be gathered whilst still quite firm. It should be carefully handled, graded for size and colour, and packed in boxes, trays, or punnets containing a single layer of fruit. It is doubtful if the methods of marketing the fruit in single layers can well be improved upon, as they are less likely to be bruised than if packed in several layers. Fruit for factory use is stemmed, placed in cans or other suitable receptacles, and forwarded as quickly as possible to the factory. Care in handling, picking, grading, or packing, always pays.

Diseases.

The most serious diseases of the strawberry in this State are those of fungus origin—viz., leaf scorch and eye spot.

A pamphlet dealing with the control of these diseases can be obtained from the Entomological Branch of the Department.

Varieties.

Although most of the standard varieties of strawberries have been grown in Queensland at one time or another, experience has shown that no one variety has proved permanent, but that it has been necessary to either raise new kinds from seed or to introduce them from elsewhere.

Varieties producing perfect flowers have proved more profitable than pistillate sorts and are therefore most commonly met with.

After being grown in this State for a few years most varieties become weaker in growth, more liable to disease, and less prolific, so that they have to be discarded. The introduction of new sorts is thus essential, and there is no better way of doing this than by raising local seedlings. Some of the best sorts ever grown in the State have been locally raised seedlings, of which the Aurie, Anetta, and Phenomenal are good examples, and there is no reason why sorts equal or even superior to these should not be produced. Of the well-known standard varieties, such as Marguerite, Trollop's Victoria, British Queen, Pink's Prolific, Federation, Melba, and Edith, and several others that have been grown from time to time in this State, few are now planted. Phenomenal (a Gympie-raised seedling) and Aurie, another variety of local origin, are now the varieties most commonly met with; other new varieties are being tested and some of them may prove to be adapted to our local conditions. The type of strawberry best suited to this State is a vigorous healthy grower—that is, a good bearer and producer or good coloured fruit of good, firm texture and fine flavour; a fruit that keeps and carries well, and that meets the requirements of both the fresh fruit trade and of the jam maker.

As strawberry seed is freely produced and readily germinates, raising seedling plants, which usually fruit the following season, is recommended. By careful selection there is reasonable possibility of effecting improvement on existing varieties. Seed should not be collected indiscriminately but from fruit freely produced on plants showing marked vigour.

FEEDING OF PIGS.

Feeding tests being carried out at the Animal Health Station, Yeerongpilly, in which fifty-five pigs from two months' old upwards are being fed on rations comprising cereal meal, protein meal, minerals, and protein supplements are of particular interest, in view of the comparatively low prices of maize and wheat. These grains and the meals resultant from grinding them are cheap enough to warrant special consideration in regard to their values as pig foods.

A prominent American authority recently stated that under present conditions in Ohio pigs can be fed most efficiently and cheaply by dependence principally upon corn supplemented by protein concentrates from both animal and plant sources, with a limited quantity of mineral matter. Emphasis is given to the value of feeding these different grains in self-feeders, specially provided for the purpose, similar to those in use in the Yeerongpilly experiments.

It is well to remember that the pig, by nature, is a consumer of concentrates; his digestive organs cannot utilise the proportion of roughage or fibre in the ration that milch cows require. Pigs cannot profitably consume more than 9 or 10 per cent. of fibre in their rations, although they will consume more if permitted, but the additional quantity is more or less wasted in the process of digestion.

Brood sows and mature stock may be fed more roughage and fibre than pigs being finished for market. That the system of marketing farm crops on the hoof is practicable is proved by the fact that seven of the corn-belt States in America comprise what is probably the greatest hog-feeding area in the world, the grains used being corn, wheat, rye, and barley, and their by-products.

In feeding these cereals and cereal meals protein concentrates are essential. Animal proteins are usually more efficient in proportion than those from plant sources, hence the world-wide preference for milk and milk by-products, and meat meal in particular. One per cent. of the ration may be mineral matters, such as sterilised bone meal, ground limestone, and charcoal. The addition of a small percentage of salt to the rations fed to pigs is payable where the rations are deficient in this mineral. The Yeerongpilly experiments will be watched with considerable interest by all engaged in the feeding and marketing of pigs.

Broom Millet.

Some years ago we were permitted to reprint a bulletin on broom millet by Mr. G. Marks (then Inspector of Agriculture, Hawkesbury Agricultural College), Manager of the Government Experiment Farm at Grafton, New South Wales, and published by the New South Wales Department of Agriculture. In response to numerous inquiries from different parts of the State on the cultivation, harvesting, and marketing of broom millet, it is deemed advisable to reprint Mr. Marks' bulletin again, although in a somewhat abridged form.—Ed.

Requirements of the Trade.

In the manufacture of brooms, three classes of brush are required, which are popularly known as "inside," "cover," and "hurl."

"Inside" millet is used for forming the inside of the broom, and is generally not more than 17 inches long.

"Cover" is the class used for covering the inside and also for forming the shoulders. It is longer than the former, and must be from 17 to 20 inches in length.

"Hurl" is the longest brush, ranging from 20 to 25 inches. It must also be fine and straight, and forms the outside covering of the broom. To give a nice finished appearance, only prime hurl can be used.

About 1½ lb. of brush are required to make an ordinary broom, and the three grades are used in about equal proportions.

The soil, climate, and methods of cultivation determine largely the quality of the brush, but in an average season there would be sufficient of each produced to satisfy the requirements of the trade. When grown under exceptionally favourable conditions, a larger proportion of long brush is produced. It may be used as covers, but owing to its length a certain amount has to be cut off, so that its use for this purpose causes unnecessary waste. On the other hand, a dry season will have the effect of stunting the growth, producing a large percentage of "inside" millet, which can only be worked in the inside of brooms. Manufacturers have consequently to purchase elsewhere to satisfy their requirements.

It is not intended to go into detail concerning the manufacture of brooms, as this does not exactly concern the grower. Manufacturers require certain classes, and the farmer should aim at producing those classes which invariably give profitable returns.

Fully 90 per cent. of the millet produced in New South Wales is grown on the rich alluvial lands of the North Coast; and on several of these rivers—notably the Hunter, Manning, and Richmond—the industry may be looked upon as lucrative and permanent. Many farmers have reported their success with this crop, and would not think of reverting to the far less remunerative occupation of maïzegrowing. The raising of millet need not be confined to these districts, as, with the necessary care, and the aid of a few home-made contrivances, any land which produces 25 or more bushels of maize to the acre will yield profitable returns. On many of our western slopes millet should also thrive,

particularly in those localities where irrigation can be carried out. It is advisable, before entering extensively into the production of broom millet, to ascertain from agents or manufacturers the probable requirements of the trade, with the view of obtaining an idea of the prices likely to be obtained during the season. At the same time, should the prices fall after the crop is harvested, the millet may, if properly cured and baled, be stored for a considerable length of time without injury.

The following information may enable beginners in broom millet growing to avoid some common mistakes, and not to neglect any of the important operations which are essential to success:—

What Broom Millet Is.

Andropogon sorghum vulgare is a non-saccharine variety of sorghum. It is an annual, somewhat similar in appearance to maize while young; but it has thinner stems and narrower leaves, and, instead of having male and female flowers on separate parts of the plant, they are both found together in the brush at the top. The flowers are of two kinds —perfect and imperfect. The former are set directly upon the branch, and are accompanied by some of the latter, raised upon little stalks. The fine stems of the panicle or brush are the valuable portions; the other parts are incidental. The brush should be composed of seed stems, uniform in size, length, elasticity, and toughness, and of a nice bright colour. The soil and general methods of cultivation will largely affect the character and quality of the product, even though good seed be used. By long and careful cultivation and systematic selection certain desirable qualities have been developed and fixed, which remain only so long as the conditions which brought these changes about are reasonably observed. When a plant is grown for a particular purpose it should be the cultivator's aim to keep improving it in the direction most profitable to him. This necessitates a careful study of the plant and its requirements, and the conditions which make for its proper development. In broom millet it is not desirable to obtain a heavy yield of seed, a large development of stalk and leaf, or a sap full of saccharine material, but a special and unusual development of the long, thin stems of which the brush is composed. It makes very little difference whether a large plant is produced or a heavy crop of seed is obtained, provided these stems are long and fine.

Class of Land Required.

The soil requirements of broom millet are similar to those of maize. The best results are obtained from the deep, rich, well-drained alluvial lands of our rivers. It is, however, capable of adapting itself to a variety of conditions, and with proper care and attention, sandy and even gravelly soils, if thoroughly drained, will produce fair returns. Undrained lands make the working and cultivation more difficult; the growth is generally slow and uneven, and there is always the liability of the crop becoming stunted and diseased. To ensure evenness in ripening a soil uniform in character and fertility is essential.

Place in the Rotation.

In the general rotation on the farm, broom millet takes the same place as maize. It is not advisable to adopt the practice of growing it in the same piece of land continuously, unless suitable fertilizers are applied. It has been found, however, in dry seasons, that it does not thrive as well on land following millet as where the previous crop was

maize. The reason of this appears to be that, being more drought-resistant, it continues to grow, and thus exhausts the soil of its supplies of moisture and plant-food, when maize would probably cease growing. At the same time, as the brush is usually harvested soon after the flowers have set, the crop can scarcely be classed as a very exhaustive one, particularly if the stalks are cut down immediately afterwards. Where possible, it should follow a leguminous or root crop.

Preparation of the Land.

To obtain the best results, the land must be properly prepared and brought to a fairly fine tilth before sowing. The previous treatment should be such as would destroy weed seeds. The presence of weeds in the early stages seriously interferes with the growth and cultivation of the young plants. Deep ploughing is recommended. This not only ensures greater feeding room for the roots, but it also has the effect of increasing the moisture-carrying capacity of the soil—a fact which must always be remembered, especially in those districts where the rainfall is limited and irregular.

The nature of the subsoil must also be considered. Clays should not be brought to the surface, but can be materially improved by subsoiling. Ploughing operations should be commenced a couple of months before sowing time. This not only allows the land to sweeten by exposure to the weather, but all vegetative growth turned under is generally well decomposed by the time the second ploughing takes place. In early spring the land should be well fined down by means of the harrow, disc, roller, &c.

Sowing and Cultivation.

Sowing should not take place until all danger of frost is over and the soil is thoroughly warmed, so that the seed will germinate at once. September, October, and November are usually the best months. If planted too early, there is not sufficient heat in the soil to cause the seed to germinate, and it will either rot or the young plants will be so weak that the weeds will very quickly outgrow and smother them. It may be sown about the same time as maize, or two or three weeks later, with advantage. Drills 4 or 5 inches deep are struck out with a plough (a double mould-board one is preferable) about 3 or 3½ feet apart, and the seed planted along these by hand or machine. The latter is preferable, as it sows more uniformly; and, by using a fertilizer attachment, chemical fertilizers may be applied at the same time. An ordinary maize seed-drill, which sows and covers the seed in the one operation, is one of the best for the purpose. During hot or dry weather the seed should be sown soon after the drills are opened, and before the soil has had time to dry. When this system is adopted, hilling can be dispensed with. It prevents a great deal of evaporation from the soil by exposing a smaller surface. Besides this, the plants, having their roots deep in the soil, have plenty of support, and are not so quickly affected by dry weather. The amount of seed varies from 5 to 8 lb. to the acre. When the plants are 6 inches high, they should be thinned out to 3 or 4 inches apart for rich soil, and more space allowed each plant in poor ground. With good, clean, and evenly-graded seed, the sowing may be adjusted so that very little thinning is necessary, thereby saving a tedious and rather expensive operation. The quality of the brush is affected to a very large extent by the manner in which this thinning is carried out. If too much space is allowed, the plants grow very strong and vigorous

and produce brush which is coarse and unsuitable for market. On the other hand, if crowded too much they become very fine and weak. To obtain an even crop, it is essential to have uniform sowing and germination, and later on to thin the plants to a uniform distance. Some growers prefer to sow the seeds in "hills," 15 to 20 inches apart in the drills, leaving from six to ten stalks to each. The seed should be covered from ½ to 1 inch deep, the depth depending upon the character and condition of the soil. If it is dry, deeper covering is more necessary than would be the case if the soil were in a good moist condition. Where labour is scarce, several sowings should be made in succession to enable the grower to deal with his crop at regular intervals, and not have the whole area mature at the same time. Rolling the land as the seed is planted ensures a quicker germination and a better stand, particularly if the soil is a little dry. When drilled, the roller at the rear of the machine is quite sufficient. Should heavy rains fall after sowing, and before the seed has germinated, a light harrow should be used as soon as the condition of the soil will admit. When 6 inches high, the crop may be harrowed to keep the soil loose and to gradually fill in the drills, and thus destroy any young weeds. Broom millet makes rather slow growth for the first couple of weeks, and the cultivator should be kept going every fortnight or three weeks, to keep the surface soil loose and friable, to conserve moisture, and prevent weed growth, and in every instance after rains. For large areas, a two-horse spring tine cultivator may be used. When the crop is half grown, under favourable conditions cultivation may cease; in any case the surface roots must not be disturbed by cultivating too deeply. In moist and exposed situations the crop may be lightly hilled, as an extra support is necessary. It is during the early stages of growth that the cultivator is of greatest value, as the soil may then be loosened fairly deeply. The most critical period is when the heads are forming. If dry weather should set in then, the brush will be short and stunted. It may be necessary in some districts to sow early or late in the season so that the crop will not come into flower during such trying conditions. Where irrigation is practised, it is essential to plant in suitably graded land and convey the water by means of open drills between the rows. After each application of water, and as soon as the nature of the soil will allow, the soil must be well cultivated to prevent caking and to conserve moisture.

Manuring.

On soils that are somewhat poor, it is advisable to apply fertilizers. Such crops as cowpeas, field-peas, vetches, and clovers are suitable for green manuring, and may be ploughed under when they have reached the blooming stage or have been grazed off by stock. This latter system works well when mixed farming is carried out, and stock of different kinds are kept. Any vegetable matter should be ploughed under early, to give it ample time to decompose before sowing. Farmyard manure, if available, is also a first-rate manure to apply, as it not only supplies the elements required by the plants, but also improves the mechanical condition of the soil. Chemical manures are also valuable, and are very easily applied. Superphosphate, bone-dust, dried blood, and sulphate of potash will be found the most suitable. The quantities used for maize or sorghum will do equally well for broom millet. The following make

a complete fertilizer, and may be applied at the rate of 2 to 2½ cwt. per acre:—

Superphosphate	80 lb.
Dried blood	64 „
Bone-dust	50 „
Sulphate of potash	30 „

The manures should be passed through a sieve, to remove lumps and foreign substances that would prevent them from passing freely through the drills. They should be thoroughly mixed just before sowing, as, if mixed any great length of time before required, they are very liable to "set," especially if the weather is at all damp, and this necessitates breaking up and rescreening before use. It is impossible to state definitely what quantity of manure is required for each class of soil. Growers would do well to conduct experiments on a small scale with manure, mixed in varying proportions, and to notice which give the best results. Soils, even in one locality, often vary considerably in their chemical and physical characters, and by such tests the farmer may soon determine the most suitable mixture for his land.

An excessive dressing of manure tends to produce a strong coarse brush.

Bending the Heads Over.

The practice of bending the heads over is not carried out extensively in this State, and as a result a large amount of bent brush is sent to market, which can be used only as "insides" or "covers." In many parts of the United States of America this operation is never neglected. When allowed to grow in the natural way, a large percentage of the brush will spread out, and bend over on account of the weight of the seed, and this reduces its market value. This is especially the case if there is good rain when the brush is forming. The rapid growth causes the panicles composing the head to become tender, and unable to bear the weight of the growing seed. Strong winds, at this particular period, will also cause this, and grain-eating birds, when plentiful, are sometimes responsible for a great deal of damage. The illustrations show examples of the brush thus destroyed.

This loss may be prevented by bending the head over, and the weight of the seed in maturing will cause the brush to lie close and straight. The turning must be done between the joints or nodes, as if done on the joints the stem will snap and the top die off. The bending checks the flow of sap a little, but the growth in the head is not materially affected. This operation is performed when the seed is beginning to fill out, and the brush shows signs of spreading.

It should be understood that it is quite possible to grow millet without turning down the heads. Some of the best millet on the market is grown by farmers who do not favour the operation. At the same time, there are seasons when a fairly large percentage is completely spoilt, and such losses could have been prevented by the adoption of this system. The stalks are bent about a foot below the base of the head, and, if the plants are very tall, there may be two bends, as shown in illustration. The heads should hang clear of the ground, so that they will not be damaged by rubbing, or discoloured by the splashing of mud in rainy weather.

Harvesting and Curing.

No matter what care has been bestowed upon the cultivation of the crop, sound judgment must be exercised at time of harvesting. An excellent crop may be brought successfully as far as this stage, and yet the result be unprofitable on account of inattention to, or ignorance of, some apparently unimportant detail. The time to harvest and the various other operations required to prepare the millet for market are such as require some experience in order to do them properly. Even experienced growers are not unanimous on the point of when to harvest the brush, some cutting the heads when in blossom, and others harvesting later so as to obtain better developed seed possessing considerable nutritive value. The time to cut will depend upon the weather and the colour required. Manufacturers generally prefer a millet having a green tinge. It is then much tougher than when allowed to become nearly ripe. To obtain this green colour the millet should be cut when the seeds are in what may be called the dough stage. The brush is then fully developed, but the grain is soft. For some classes of goods a golden colour is preferred, in which case the crop is left till the grain is fairly firm. With a little experience it is easy to harvest a large area, and yet maintain a uniform tint. A strong knife (a pruning knife is very suitable) is used to cut the brush, and at least 6 inches of stalk should be left on. In dwarf varieties the brush should be pulled instead of cut. Select fine weather for this operation. Some growers bend the stalks of drills towards each other diagonally, about 2 or 3 feet from the ground, forming a sort of platform upon which the cut heads are placed to dry. Others cut the whole of the stalks, and lay the millet upon them.

Drying in the Field.

In this State the millet may be properly dried in the field during the greater portion of the summer months. Should thunderstorms occur, the brush must be placed in heaps and covered with tarpaulins, sheets of iron, or other material. The time required for drying depends upon the season, but still, with fine bright weather, two days should be sufficient. The brush must not be allowed to get wet, as rain or dew soon discolours it.

Drying under Cover.

The finest colour is obtained by drying under cover, or away from the direct rays of the sun. The millet is left a couple of hours in the field for some of the moisture to evaporate before being taken to sheds fitted up with racks one above the other, so that the brush may be spread out in layers about 3 inches deep. It must be turned regularly at frequent intervals, and when nearly dry may be placed in thicker layers. This method requires plenty of space and a good deal of attention, and it takes longer to dry.

Removal of the Seed.

The seed is removed by means of a hackler.

The machine consists of a roller studded with small iron spikes, mounted in a frame and made to revolve at high speed. A handful of the brush is held so that the roller comes in contact with the seeds, which are speedily stripped off. A firm at Morpeth specialise in millet machinery, and supply these in hand, horse, or belt power for about £4 10s. and £5 10s. respectively.

For small quantities a handy man can very easily make one, but it is best to purchase one, properly constructed, for treating large amounts.

Grading.

The grading of millet is most important, and must not be overlooked. While grading cannot be done so cheaply or expeditiously on the farm as in the factory, still, in the grower's "own interest, it is essential that some grading be done." It should be sorted into at least three classes —"Inside," "Covers," and "Hurl"; and any which cannot be honestly included in any of these classes should be discarded. Green and golden should also be kept separate.

Baling.

The various grades should be baled separately. For this purpose a press is required. One used for lucerne or other hay can be conveniently adapted for this purpose. It is important, especially where space is charged for in freight, to reduce the bulk as far as possible. The brush is laid with butt ends outwards and the heads overlapping in the middle. Battens may be placed on top and bottom of the bales, and when pressed the whole is secured by five fairly stout wires. The size varies with individual growers; but a bale 46 inches by 30 inches by 24 inches, and weighing from 300 to 400 lb., can be recommended. Each bale should be legibly branded with an indication of the quality. There are several styles of home-made presses in use, but one that is coming largely into favour is made on similar lines to a wool-press, having wire ropes and a lever.

Yield.

The yield ranges from 10 to 15 cwt. of clean marketable brush, and 25 to 30 bushels of seed per acre. The price of broom millet fluctuates considerably with the season; and while it may vary from £18 to £40 per ton, the general average for prime hurl may be set down at £30, cover millet at £25 to £30, and inside millet at £20 per ton. Should the prices, however, be somewhat low when harvesting takes place, the millet may be stored for any length of time without deterioration, and disposed of when higher prices are obtainable.

On account of the seed not being properly developed, it is best to consume it on the farm. Its value may be estimated at 4s. per 4-bushel bag.

Selection of the Seed.

Special attention must be given to the selection of the seed. That obtained in the process of stripping should not be used for sowing. The practice of using such would speedily lead to deterioration and the production of inferior brush.

Good reliable seed can only be obtained by sowing in special areas and allowing the plants to mature their seed naturally. Individual plants may be allowed to ripen their seed in an ordinary field, but there is always a danger of them being hybridised by pollen from plants having inferior brush. In any case, seed should be obtained from those which produce the best heads. By proper cultivation and selection the quality and yield of any variety may be improved. Where seed-eating birds are troublesome, it may be necessary to cover the heads with some light material, such as muslin, when the seed is commencing to fill out. The ends must be tied loosely round the stalk so as not to interfere with

the free circulation of the sap. After harvesting, the heads are thoroughly dried, threshed, cleaned, and kept in a place secure from weevils and damp.

Where the conditions for saving seed are not suitable it is best to purchase from reliable seedsmen. There are several varieties on the market, but so far White Italian has given the best results in this State. At the same time, growers are advised to experiment with new varieties from time to time, or introduce fresh strains of those kinds they have in constant cultivation, with the view of finding out what particular kind is most suitable to their conditions.

By-products.

The object of the cultivator should be produce brush of the best quality; consequently all other use of the plant must give way to this. In former years millet was allowed to develop a fair proportion of seed, but the diminished value of the brush was not compensated for by the value of the seed obtained. The finest green brush is usually obtained while the seed is in an immature condition, but in the production of good golden-coloured millet a fair proportion of the grain is more or less developed. This contains an amount of nutriment, and can be utilised for the feeding of stock, thus assisting in reducing the expenses of the crop. It is, however, generally more or less soft and doughy, and, if intended to be kept for any great length of time, should be thoroughly dried by spreading out in thin layers on tarpaulins. Growers who insist upon ripening their seed will secure brush of an inferior quality, which brings a low price upon the market, and if exported injures the trade.

Stalks and Leaves.

The plant cannot be recommended as a particularly useful one for feeding purposes. While young a certain amount of sugar exists in the sap, but this soon disappears, and by the time the brush is cut the stalks are more or less dry or pithy, and contain a large proportion of fibre matter which is unpalatable. For this reason very little use is made of them beyond turning stock in after the harvest to feed upon the leaves. The refuse should afterwards be cut up with a heavy disc harrow, or cornstalk cutter, and ploughed under for manure.

TO SUBSCRIBERS—IMPORTANT.

Several subscriptions have been received recently under cover of unsigned letters. Obviously, in the circumstances, it is impossible to send the journal to the subscribers concerned.

It is most important that every subscriber's name and address should be written plainly, preferably in block letters, in order to avoid mistakes in addresses and delay in despatch.

Piggery Management.

By L. A. DOWNEY, H.D.A., Instructor in Pig Raising.

TO make a success of pig raising, it is essential to commence with good pigs, ample foods of the correct kinds, and good accommodation for the stock, but these factors alone are not sufficient to reasonably insure the success of the venture; it is further essential that the farmer should have a thorough knowledge of the care and management of his pigs in order that he may make the best use of his resources.

Handling the Boar and Sows Prior to Mating.

Young pigs should be well grown before mating; breeding from animals too early in their growth will, in a few generations, ruin their size, which is the most important characteristic of any pig. If the farmer wants to have large and fast-growing pigs, he must breed them that way as well as feed them that way. All the feed in the world won't make a draught horse of a pony colt, and the same applies to pigs—they must have size (which means fast and lean growth) bred into them. Usually pigs are well enough grown for mating at nine or ten months of age, or over 250 lb. live weight, and boars and sows must be kept apart until they reach that stage. If this is not done they will mate, perhaps, at five months of age.

Young boars and sows intended for breeding should be grazed in good paddocks and given ample flesh-forming foods, such as lucerne and separated milk, with a limited supply of grain, the object being to keep them in good thrifty growing condition and yet not too fat; if the breeding stock become too fat there is a risk of them not breeding satisfactorily. This is also the case where breeding pigs are kept in low condition. There is a medium condition which should be aimed at.

Mating.

For best results the boar should be kept in a separate enclosure to the sows, and when a sow is hogging (which is usually well indicated to the intelligent pig-raiser) she should be placed with the boar, and allowed one service, then removed, and if it is practicable, she should be put in a yard on her own so that she will not be knocked about by other pigs riding her. Then it may be advisable to allow the sow to return to the boar for a second service on the following day. If the sow does not hold to the service she will be in season again in twenty-one days. The period of heat (œstral period) usually lasts for two days, although it varies in different sows from one to three days.

After the service has taken place it should be recorded in a "breeding" book, together with the date, then three weeks later the sow should be watched to see if she returns to service. From this book entry the expected date of farrowing can be determined by reference to a gestation chart. The gestation period is approximately 112 days (easily remembered as approximately three months, three weeks, and three days). This period varies considerably and is usually less than 112 days with young sows and more than 112 days with old sows.

Care of In-pig Sows.

At service time, the sow is usually in medium condition. She should then be fed so as to have her gradually improving up to farrowing time, when she should be in her best form but not excessively fat. This condition can be obtained by good management and feeding without any forcing with fattening foods. Firstly, the sow should be given the run of a good grazing paddock where she will be able to forage for some of her food, and thus she may be kept at a low cost. The in-pig sow should be kept away from disturbances, such as dogs, horses, cattle, and other sows which are hogging, as rough treatment or excitement may cause a sow to abort. The feeding-trough should be arranged so that in-pig sows do not have to scramble and fight for their food. A lucerne paddock is an ideal place for dry sows; they also do well if allowed to roam over old cultivation paddocks or on root crops, such as artichokes and sweet potatoes, where they can harvest their food, thus getting the necessary exercise. Separated milk is a very valuable food for in-pig sows; they should also be given free access to clean drinking water. If maize is fed to in-pig sows, it should be given sparingly. The sows should have a warm, dry, shelter shed into which they can go for protection from the extremes of the weather. Shade trees are also very useful in the paddocks.

Plate 114.

The number and weight of the pigs reared in each litter reflect the efficiency of the business.

Towards the end of the gestation period it is very advisable to clean all the lice off the sow so that the young pigs will not be infested soon after they are born. To destroy the lice, the sow should receive three applications, one week apart, of either a weak coal-tar disinfectant solution, or some cheap grade of oil. These should be either sprayed or rubbed on to every part of the pig's skin.

Farrowing Time.

About a fortnight before the sow is expected to farrow she should be taken from the herd and placed in a run on her own where she can go into a clean and comfortable shed. Some short, dry grass or straw should be put into the shed for bedding, and this should be changed when necessary to keep the bed clean and dry. Exercise is essential at this period to prevent the sow from becoming constipated, which would cause trouble in parturition and may be followed by fever. Just prior to farrowing the sow should be fed very lightly, and the food should be of a laxative nature—green foods and a little molasses are very useful.

The sow should be kept as quiet as possible at farrowing time, although it is advisable to be with her if possible, not to interfere, but to be ready to give assistance if it is required. In attending a farrowing sow it is necessary to use a lot of common sense in conjunction with a knowledge of anatomy and physiology.

The Suckling Period.

It is important that the sow should not be fed for about twenty-four hours after farrowing, unless it is to give her a small drink. The first feed should be a light one, half-a-cupful of castor oil added to the first feed will help to put the sow in good form. For the first three weeks after farrowing the sow should be fed lightly, as overfeeding at this stage is a common cause of scours in the suckers. From the third week onwards the feed can be given freely, as at this stage the young pigs make most use of their food. When three weeks old the suckers should be provided with some food in a low trough; this in addition to the sow's milk, helps the young ones along and they are thus well grown at weaning time. A self-feeder may be used to advantage at this period.

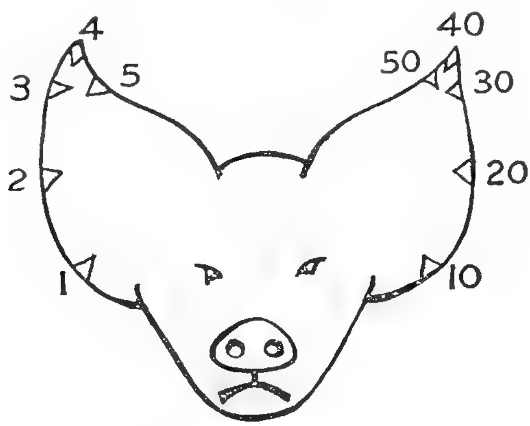


PLATE 115.—EAR-MARKING SYSTEM BY NUMBERS.

The male pigs not required for breeding should be castrated when six weeks old, as at this age the operation is easily performed and it has little ill effect on the pigs, which quickly recover if the operation is done properly and they are treated with some disinfectant, then put into a clean grass run. Ear tattooing and ear-marking can be done at the same time as castration.

GESTATION CHART FOR BREEDING SOWS.

Jan.	Date of Farrow-ing.	Feb.	Date of Farrow-ing.	March.	Date of Farrow-ing.	April.	Date of Farrow-ing.	May.	Date of Farrow-ing.	June.	Date of Farrow-ing.	July.	Date of Farrow-ing.	Aug.	Date of Farrow-ing.	Sept.	Date of Farrow-ing.	Oct.	Date of Farrow-ing.	Nov.	Date of Farrow-ing.	Dec.	Date of Farrow-ing.
1	22 April	**1**	23 May	**1**	20 June	**1**	21 July	**1**	20 Aug.	**1**	20 Sept.	**1**	20 Oct.	**1**	20 Nov.	**1**	21 Dec.	**1**	20 Jan.	**1**	20 Feb.	**1**	22 Mar.
2	23 ,,	**2**	24 ,,	**2**	21 ,,	**2**	22 ,,	**2**	21 ,,	**2**	21 ,,	**2**	21 ,,	**2**	21 ,,	**2**	22 ,,	**2**	21 ,,	**2**	21 ,,	**2**	23 ,,
3	24 ,,	**3**	25 ,,	**3**	22 ,,	**3**	23 ,,	**3**	22 ,,	**3**	22 ,,	**3**	22 ,,	**3**	22 ,,	**3**	23 ,,	**3**	22 ,,	**3**	22 ,,	**3**	24 ,,
4	25 ,,	**4**	26 ,,	**4**	23 ,,	**4**	24 ,,	**4**	23 ,,	**4**	23 ,,	**4**	23 ,,	**4**	23 ,,	**4**	24 ,,	**4**	23 ,,	**4**	23 ,,	**4**	25 ,,
5	26 ,,	**5**	27 ,,	**5**	24 ,,	**5**	25 ,,	**5**	24 ,,	**5**	24 ,,	**5**	24 ,,	**5**	24 ,,	**5**	25 ,,	**5**	24 ,,	**5**	24 ,,	**5**	26 ,,
6	27 ,,	**6**	28 ,,	**6**	25 ,,	**6**	26 ,,	**6**	25 ,,	**6**	25 ,,	**6**	25 ,,	**6**	25 ,,	**6**	26 ,,	**6**	25 ,,	**6**	25 ,,	**6**	27 ,,
7	28 ,,	**7**	29 ,,	**7**	26 ,,	**7**	27 ,,	**7**	26 ,,	**7**	26 ,,	**7**	26 ,,	**7**	26 ,,	**7**	27 ,,	**7**	26 ,,	**7**	26 ,,	**7**	28 ,,
8	29 ,,	**8**	30 ,,	**8**	27 ,,	**8**	28 ,,	**8**	27 ,,	**8**	27 ,,	**8**	27 ,,	**8**	27 ,,	**8**	28 ,,	**8**	27 ,,	**8**	27 ,,	**8**	29 ,,
9	30 ,,	**9**	31 ,,	**9**	28 ,,	**9**	29 ,,	**9**	28 ,,	**9**	28 ,,	**9**	28 ,,	**9**	28 ,,	**9**	29 ,,	**9**	28 ,,	**9**	28 ,,	**9**	30 ,,
10	1 May	**10**	1 June	**10**	29 ,,	**10**	30 ,,	**10**	29 ,,	**10**	29 ,,	**10**	29 ,,	**10**	29 ,,	**10**	30 ,,	**10**	29 ,,	**10**	1 Mar.	**10**	31 ,,
11	2 ,,	**11**	2 ,,	**11**	30 ,,	**11**	31 ,,	**11**	30 ,,	**11**	30 ,,	**11**	30 ,,	**11**	30 ,,	**11**	31 ,,	**11**	30 ,,	**11**	2 ,,	**11**	1 Apr.
12	3 ,,	**12**	3 ,,	**12**	1 July	**12**	1 Aug.	**12**	31 ,,	**12**	1 Oct.	**12**	31 ,,	**12**	1 Dec.	**12**	1 Jan.	**12**	31 ,,	**12**	3 ,,	**12**	2 ,,
13	4 ,,	**13**	4 ,,	**13**	2 ,,	**13**	2 ,,	**13**	1 Sept.	**13**	2 ,,	**13**	1 Nov.	**13**	2 ,,	**13**	2 ,,	**13**	1 Feb.	**13**	4 ,,	**13**	3 ,,
14	5 ,,	**14**	5 ,,	**14**	3 ,,	**14**	3 ,,	**14**	2 ,,	**14**	3 ,,	**14**	2 ,,	**14**	3 ,,	**14**	3 ,,	**14**	2 ,,	**14**	5 ,,	**14**	4 ,,
15	6 ,,	**15**	6 ,,	**15**	4 ,,	**15**	4 ,,	**15**	3 ,,	**15**	4 ,,	**15**	3 ,,	**15**	4 ,,	**15**	4 ,,	**15**	3 ,,	**15**	6 ,,	**15**	5 ,,
16	7 ,,	**16**	7 ,,	**16**	5 ,,	**16**	5 ,,	**16**	4 ,,	**16**	5 ,,	**16**	4 ,,	**16**	5 ,,	**16**	5 ,,	**16**	4 ,,	**16**	7 ,,	**16**	6 ,,
17	8 ,,	**17**	8 ,,	**17**	6 ,,	**17**	6 ,,	**17**	5 ,,	**17**	6 ,,	**17**	5 ,,	**17**	6 ,,	**17**	6 ,,	**17**	5 ,,	**17**	8 ,,	**17**	7 ,,
18	9 ,,	**18**	9 ,,	**18**	7 ,,	**18**	7 ,,	**18**	6 ,,	**18**	7 ,,	**18**	6 ,,	**18**	7 ,,	**18**	7 ,,	**18**	6 ,,	**18**	9 ,,	**18**	8 ,,
19	10 ,,	**19**	10 ,,	**19**	8 ,,	**19**	8 ,,	**19**	7 ,,	**19**	8 ,,	**19**	7 ,,	**19**	8 ,,	**19**	8 ,,	**19**	7 ,,	**19**	10 ,,	**19**	9 ,,
20	11 ,,	**20**	11 ,,	**20**	9 ,,	**20**	9 ,,	**20**	8 ,,	**20**	9 ,,	**20**	8 ,,	**20**	9 ,,	**20**	9 ,,	**20**	8 ,,	**20**	11 ,,	**20**	10 ,,
21	12 ,,	**21**	12 ,,	**21**	10 ,,	**21**	10 ,,	**21**	9 ,,	**21**	10 ,,	**21**	9 ,,	**21**	10 ,,	**21**	10 ,,	**21**	9 ,,	**21**	12 ,,	**21**	11 ,,
22	13 ,,	**22**	13 ,,	**22**	11 ,,	**22**	11 ,,	**22**	10 ,,	**22**	11 ,,	**22**	10 ,,	**22**	11 ,,	**22**	11 ,,	**22**	10 ,,	**22**	13 ,,	**22**	12 ,,
23	14 ,,	**23**	14 ,,	**23**	12 ,,	**23**	12 ,,	**23**	11 ,,	**23**	12 ,,	**23**	11 ,,	**23**	12 ,,	**23**	12 ,,	**23**	11 ,,	**23**	14 ,,	**23**	13 ,,
24	15 ,,	**24**	15 ,,	**24**	13 ,,	**24**	13 ,,	**24**	12 ,,	**24**	13 ,,	**24**	12 ,,	**24**	13 ,,	**24**	13 ,,	**24**	12 ,,	**24**	15 ,,	**24**	14 ,,
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27	18 ,,	**27**	18 ,,	**27**	16 ,,	**27**	16 ,,	**27**	15 ,,	**27**	16 ,,	**27**	15 ,,	**27**	16 ,,	**27**	16 ,,	**27**	15 ,,	**27**	18 ,,	**27**	17 ,,
28	19 ,,	**28**	19 ,,	**28**	17 ,,	**28**	17 ,,	**28**	16 ,,	**28**	17 ,,	**28**	16 ,,	**28**	17 ,,	**28**	17 ,,	**28**	16 ,,	**28**	19 ,,	**28**	18 ,,
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30	21 ,,	—	—	**30**	19 ,,	**30**	19 ,,	**30**	18 ,,	**30**	19 ,,	**30**	18 ,,	**30**	19 ,,	**30**	19 ,,	**30**	18 ,,	**30**	21 ,,	**30**	20 ,,
31	22 ,,	—	—	**31**	20 ,,	—	—	**31**	19 ,,	—	—	**31**	19 ,,	**31**	20 ,,	—	—	**31**	19 ,,	—	—	**31**	21 ,,

NOTE.—Heavy figures in above table indicate date of service.

This chart presents in an instructive form figures relating to the gestation period of brood sows. For example, a sow mated to the boar on 1st January is due to farrow on 22nd April; a sow mated on 1st July is due on 20th October. The normal period of gestation, *i.e.*, the period from the time of conception to the birth of the young pigs, is 112 days.

SOW'S BREEDING RECORD.

Breed: Name: Registered Number: Date of Birth: Earmark:

Date of Service.	Date of Farrowing.	Sire of Litter.	Number Born.		Number Weaned.		Tattoo or Earmark Given and Date Weaned.	Died after Weaning.		Sold or Killed for Meat.		Stud Sales.		Gross Returns.	Remarks.
			Male.	Female.	Male.	Female.		Male.	Female.	Male.	Female.	Male.	Female.		

COPY OF PAGE FROM A RECORD BOOK,

Weaning.

The pigs should be weaned from the sow when they are eight to nine weeks old. After being separated for a day, the sow should be put with the litter for an hour or so for the pigs to empty her udders. This should be repeated on the following day, by which time most sows will be dry, although, in some cases, it is necessary to put the sow back to the suckers for several days before she dries off. At this time the sow's feed should be very light, so that she will not make much milk. The sow will usually come on hogging when the litter is about nine weeks old, and if she is not too low in condition, she can be mated to the boar then, but in cases where the sow's condition is very low, it is preferable to withhold the service for at least three weeks.

Record of Performance.

Just as poultry breeders record egg-laying as a measure of production of their birds, and dairy farmers test and record the production of their cows to ascertain which are the best producers, so must pig-raisers record the production of their breeding stock so that they may have a record of performance on which to select or cull their breeding stock. The system of selection by appearance alone is not sufficient. Pig recording is practised by individual breeders and in some countries by organisations and, although most systems of recording vary a little, the common factor throughout appears to be the weighing of litters of pigs at eight weeks old, the number of pigs, and individual and total weights being taken as indications of the productivity of the sow and boar, and of the efficiency of the feeding and management of the stock.

Work done in pig recording shows that a standard which breeders should aim at is an average of eight pigs reared per litter, and an average weight of 40 lb. per pig at eight weeks old.

The Growing Period.

It should be the object of the pig-raiser after weaning his pigs to have them growing rapidly until they are ready to market; there should be no "store" period, but the pigs should be fed in such a way as to have them "finished," but not excessively fat, when they reach their weight range as porkers, light baconers, or heavy baconers, as the case may be.

WHEN GOD PLANTED A GARDEN.

In the beginning . . . the Lord God planted a garden eastward in Eden; and out of the ground made the Lord God to grow every tree that is pleasant to the sight and good for food; and a river went out of Eden to water the garden; and the Lord God took the man and put him into the garden of Eden to dress it and keep it.—Genesis.

Bloat in Cattle.

THE present season with the conditions favourable to the production of an abundance of succulent green foods has given rise to a number of cases of *hoven* or *bloat* in cattle. Stockowners know that bloat is liable to affect animals that are suddenly turned into lucerne, clover, and field crops, especially when the crop is immature and wet with dew or rain. They know also that hungry cattle are more susceptible to bloat.

The condition is caused by the formation of large quantities of gas in the *rumen* or *paunch,* which results in an abnormal distension or swelling of the left flank. It is known that the food distending the paunch or rumen becomes yeasty so that it froths and foams and throws off large quantities of gas. The natural or normal way of expulsion of gas by the animal is by belching, but when the gas forms quickly and in large quantities and the stomach becomes unduly distended normal belching appears to be checked and does not occur. It has been said that the distension may cause a partial paralysis of the muscle fibres of the walls of the stomach, which prevents the normal churning motion of the stomach (Peristalsis), so essential in the preparation of the roughage for the full digestion in the fourth department of the stomach, the abomasun.

Peristalsis aids in the belching or expulsion of gases from the stomach, and when the action is checked bloating would occur. It has been suggested by nutritional chemists that the sugar content of lucerne and clover blossoms is a factor in increasing fermentation and formation of gases in the paunch, but of course this theory would not hold where the animals have eaten immature lucerne or clover which have been known to cause bloating. It may be possible that the *cyanoglucoside content* is a contributing factor apart from the flowers or blossoms.

Treatment of Bloat.

A number of remedies have been tried, and have proved more or less successful. The use of a gag to keep the mouth open, until the animal has belched the gas out by the mouth, is useful in mild attacks. Other remedies, including the internal administration of an ounce of bicarbonate of soda and an ounce of ginger, which may be repeated every two or three hours until the animal is relieved. A quart of treacle in a gallon of water has afforded relief in some cases. Two ounces of turpentine in milk has afforded relief, but in such cases it must be noted that the attack is not severe. In all cases of bloat the most effective treatment is the puncturing of the paunch.

The puncture is made in the left side of the paunch at a point equidistant from the last rib, the edge of the *loin bones,* and the angle of the *haunch.* The proper instrument to use is a trocar and canula, the canula being a tube or covering through which the trocar, a sharp-pointer instrument passes.

The instrument is thrust into the *rumen* and the trocar is then withdrawn, leaving the canula in place for the gas to escape through it. In cases of emergency when no instrument is available a knife may be

used, the gas escaping through the opening. But the use of a knife is not advocated as it may give rise to complications and cause the death of the animal if it is not carried out by a person who is experienced in it.

After the gas has escaped, the animal may be given a dose of linseed oil, $1\frac{1}{2}$ pints, turpentine a tablespoonful, mixed thoroughly by shaking while being given to the animal.

QUEENSLAND SHOW DATES, 1934.

April.

Pittsworth, 4th and 5th
Warwick, 10th to 12th
Toowoomba, 16th to 19th
Rosewood Camp Draft, 7th
Goondidwindi, 27th and 28th
Oakey, 28th
Taroom Camp Draft, 30th

May.

Taroom, 1st and 2nd (Camp Draft, 5th)
Dalby, 3rd and 4th
Beaudesert, 2nd and 3rd
Nanango, 3rd and 4th
Blackall, 7th to 9th
Chinchilla, 8th and 9th
Charleville, 8th to 10th
Crow's Nest, 9th and 10th
Boonah, 9th and 10th
Monto, 9th and 10th
Kingaroy, 10th and 11th
Ipswich, 15th to 18th
Miles, 16th
Kilkivan, 16th and 17th
Mitchell, 16th and 17th
Mundubbera, 16th and 17th
Dirranbandi, 16th and 17th
Wondai, 17th and 18th
Roma, 22nd to 24th
Gympie, 23rd and 24th
Emerald, 23rd and 24th
Biggenden, 24th and 25th
Murgon, 24th to 26th
Toogoolawah, 25th and 26th
Kalbar, 26th
Goomeri, 29th and 30th

June.

Maryborough, 1st, 2nd, and 4th
Marburg, 1st and 2nd
Childers, 5th and 6th
Gin Gin, 5th and 6th

June—*continued.*

Bundaberg, 7th to 9th
Lowood, 8th and 9th
Bororen and Miriam Vale, 11th and 12th
Wowan, 14th and 15th
Rockhampton, 19th to 23rd
Mackay, 26th to 28th
Laidley, 27th and 28th
Proserpine, 29th and 30th
Townsville Rodeo, 30th

July.

Bowen, 4th and 5th
Gatton, 4th and 5th
Kilcoy, 5th and 6th
Ayr, 6th and 7th
Townsville, 10th to 12th
Woodford, 12th and 13th
Rosewood, 13th and 14th
Cleveland, 13th and 14th
Cairns, 17th to 19th
Charters Towers, 18th and 19th
Caboolture, 20th
Nambour, 18th and 19th
Atherton, 24th and 25th
Pine Rivers, 27th and 28th

August.

Royal National, 6th to 11th
Home Hill, 31st August and 1st September

September.

Enoggera, 1st
Imbil, 7th and 8th
Ingham, 7th and 8th
Innisfail, 14th and 15th
Beenleigh, 20th and 21st
Mareeba, 20th and 21st
Rocklea, 22nd
Malanda, 26th and 27th
Kenilworth, 29th

October.

Millaa Millaa, 5th and 6th
Tully, 12th and 13th

Seasonal Farm Crops.

By A. E. GIBSON, Director of Agriculture.*

AT this period of the year, the dairy farmer and those primary producers who derive at least a portion of their income from the keeping of stock, should be giving consideration to the planting or sowing of those crops which during our recognised season of lessened rainfall will still enable them to maintain supplies to the local butter or cheese factory or top-off stock which are destined for the meat market, and it is with the idea of presenting for their consideration suitable crops for such purpose that the present lecturette has been prepared.

Land Preparation.

As with all crops, careful initial preparation is necessary and, although during periods of frequent rainfall crops of a satisfactory type can be successfully raised, it is to the careful farmer that success is ensured during those periods when the rainfall is below normal.

Having carefully prepared the land, consideration is naturally given to the type of crop which it is desired to produce and its suitability to the class of soil, and last but not least the temperate conditions required in connection with its production.

Winter Cereals and Legumes.

The dairyman with a view to continuity of green fodder supplies will naturally incline towards winter cereals; those who include the raising of pigs with their dairying activities will also give consideration to root and other crops that will maintain their growing pigs during the winter months, when skim milk supplies are usually somewhat restricted.

Barley, and preferably an awnless type, although not the earliest of the winter cereals, is one to which most attention is given. It is suited to many types of soil, but will not thrive in sour or acid soils. Severe frosts will check its growth, whilst excessive wet shows its effects in the yellowing of the leaves. It provides succulent grazing for calves, lambs, and pigs, and will stand fairly hard grazing. Where it is intended to plant for fodder purposes with a view of feeding to stock, rather than grazing off, the addition of field peas is recommended, and if sown in conjunction with skinless barley, excellent results are attained.

Field peas of the Dun, Grey, or Partridge varieties are usually available from Brisbane or Toowoomba seed merchants, the former variety perhaps being the most popular.

When used in conjunction with barley, best results are obtained by sowing at the rate of ¼ bushel to ½ bushel of peas to ¾ bushel to 1 bushel of barley, and if sown under favourable conditions of soil and moisture such will give a sufficient density of growth.

Sow now or as early as possible in the present month, and if you are possessed of a grain drill drill in at a depth of not less than 2 inches, stopping one-third of the grain runs, to aid in distributing the small quantity of seed, otherwise broadcast over and in the direction of the furrows, and follow up with one stroke of the harrows in the same direction.

* In a broadcast address from Radio Station 4QG.

The barley may then be drilled or broadcasted and followed by two harrowings, the last at right angles to the direction of the previous harrowing.

For a rotational crop, follow with a crop of oats and peas, sown in a similar manner to that recommended for barley and peas. Of all the varieties of oats grown for hay or fodder purposes, perhaps the most popular is Algerian, but of later years selections have been made which have given a somewhat wider range of better types, although many have been the result of crossing with the Algerian variety.

Perhaps for Queensland purposes Sunrise is to be preferred to Algerian and is much less liable to rust. It is an early-maturing type carrying a medium coarse straw and consequently for hay purposes should be sown slightly thicker than is usual with Algerians. It stands feeding off well.

Mulga is also a satisfactory variety for this State and is in fact a selection from Sunrise, but somewhat earlier in maturing than that variety and does well in warm districts. It is a variety of oat that can be sown for successional grazing off and lends itself admirably for fodder purposes when sown in conjunction with field peas. Sow at the rate of 1¼ bushels per acre, using the same quantity of peas as in the case of barley.

Fodder Crops for Pigs.

Where the dairyman, as he should, combines pig-raising with his dairying activities, the advantage of such crops as rape, swede turnips and field carrots, mangolds and sugar beet, should claim his attention, and under normal conditions in the cooler portions of this State give very satisfactory returns.

Rape may be sown now in drills 14 inches apart using 3 to 4 lb. of seed per acre. Dwarf Essex is the best variety for Queensland purposes, but should be cleaned up before the warm weather sets in as it is usually affected by cabbage aphis. Rape, when ploughed in, has considerable value as a soil renovator. Care requires to be taken in feeding off rape, as it is liable to cause bloat or hoven.

Swede turnips can be sown either broadcast or in drills, but the latter is preferable unless in those areas where winter rainfall is more favourable. Two to 3 lb. in drills 2 feet to 2 feet 6 inches apart will be found to be ample, but double that quantity if broadcasted. The latter system is preferable, perhaps, where it is intended to graze off the crop and climatic conditions lend themselves to such practices. Varieties recommended are Purple Top and Monarch.

Field carrots have given satisfactory results in quite a number of localities in Southern Queensland and are excellent where root crops can be utilised. Sow at the rate of 4 lb. per acre in drills spaced 2 feet 6 inches apart. White Belgian is a variety recommended.

Although in the cooler districts mangolds and sugar beet should now be above ground, in the warmer areas present month sowings will give quite satisfactory yields during the late winter and early spring months.

Mangolds and beet require to be sown in clean, well-prepared land, in drills 2 feet 6 inches apart, and when well above the surface should be thinned out with the hoe to give the roots a chance to develop. Weeds at the same time should be attended to.

Mangolds and beet are not remarkable for their germinating qualities, consequently sowings are comparatively heavy. Sow mangold seed at the rate of 5 lb. per acre. Sugar beet, however, require from 7 to 8 lb. per acre.

Long Yellow, Long Red, and Golden Tankard are amongst the best of the varieties of mangolds, whilst Vilmorin's Improved and Wanzelben are representative varieties of sugar beet.

Lucerne.

Perhaps the most valuable fodder crop to which serious consideration should be given for sowing during the months of April and May is that king of all fodders—lucerne—and as this crop will give satisfactory returns over a period of years every care should be given to the early and thorough preparation of the soil. Lucerne prefers a deep, rich, calcareous soil, and gives excellent results on the basaltic soils met with on the Darling Downs, and the Lockyer and Fassifern districts, but very good results are obtainable along alluvial creek flats, being useful where nut grass is in evidence, and for such reason it is not desirable that general cultivation be continued. A sandy loam, however, does not give satisfactory growths of lucerne, although where such is present it can be utilised when well fertilized, preferably with heavy dressings of farmyard manure, for green feed for poultry. Above all, badly drained soils are fatal to the growth of lucerne.

On new land a preparatory winter or spring crop is advisable, and when this has been harvested the stubbles should be ploughed under and the soil allowed to mellow. Any volunteer growths that appear should be subsequently ploughed under in the second ploughing, carried out at right angles to the first ploughing. The soil may be left in its rough condition and will thus absorb all rainfall that is experienced whilst lying fallow, the result being a breaking down of clods, and if given a stroke of the harrows a moderate tilth will result. At this stage weed growth should be very decidedly checked, and after each shower the ground harrowed and left loose on the surface.

If this is not given effect to, the surface becomes compacted and the greater proportion of moisture, instead of being absorbed by the soil, becomes diverted over the surface to lower levels.

At least three ploughings should be given prior to sowing, each being carried out at a greater depth to the one preceding. Surface tillage should be given effect to with the object of reducing the soil surface to that fineness of texture necessary in the preparation of an onion bed.

Of the many varieties of lucerne which have been experimented with in this State none appear to be superior or even equal to that variety which we term Broad Leaf Hunter River and, although many growers insist on none but that which is actually produced in the Hunter River district of New South Wales, I have to remind them that New South Wales is a good customer of Queensland for lucerne seed, and at the same time much is reimported. Under these conditions, provided that the seed is cleaned and is free from dodder, it would appear unnecessary to incur the cost of two railway freights when obtaining the same article.

When purchasing lucerne seed, from whatever source, it is wiser to obtain a sample from the vendor, and if in doubt of its germinating qualities such can be ascertained by submitting the sample to the Pure

Seeds Branch of the Department of Agriculture and Stock, and if such is required, a certificate not only of its percentage of germination, but of its purity can be obtained. Sow at the rate of 10 lb. per acre and, whilst on the subject of quantity of seed per acre, it should be noted that where a high percentage of germination is in evidence, the quantity of seed per acre can be lessened even down to 7 or 8 lb. without materially lessening the density of the subsequent "stand." A frequent cause of bad germination in the field is sowing at an excessive depth, half an inch being ample provided that conditions for sowing are as they should be.

I once inspected in the Boonah district an area sown just prior to rain that only received 7 lb. per acre, when rain fell and prevented the owner from carrying out his original intention of sowing a further 7 lb. at right angles to the direction of the first sowing. Before he could complete the operation, the young plants were in evidence. The stand of lucerne so obtained was dense enough for practical purposes and I understand gave satisfactory cuttings for several years.

WHEATGROWING ON THE DAWSON.

Speaking on the wheatgrowing possibilities on the Dawson River country on his return from a recent visit to that region, Mr. T. L. Williams, M.L.A. (Port Curtis), said:—

One thing that struck me somewhat forcibly during this visit was the fact that many of the settlers in the lower end of the Dawson Valley and the western portions of the Callide Valley lands in particular could very profitably engage in wheatgrowing on the larger outside areas. Several settlers in fact, have carried out "trial" experiments in this direction, with considerable and heartening success.

Among the number are Messrs. C. and F. Letchford, two comparatively new settlers a few miles out from the Theodore township in the dry, or non-irrigable section, who last year planted approximately 250 acres with wheat, from which the return was in the vicinity of 1,200 bags. The land received no special treatment or preparation, and was not even fallowed, being prepared late and planted to suit weather conditions pervailing at the time.

When dealing with this matter some years ago, on the occasion of a previous visit, I remarked at some length on the possibility of wheatgrowing in the Dawson and Callide Valley Areas, and said at the time that there was an undoubted future for wheatgrowing in the Theodore Settlement Area (more particularly in the adjacent holdings, which ultimately may form a part of the area to come under future direct settlement). There are, in fact, many thousands of acres of land suitable in every way for its cultivation and production in portions of the Woolthorpe, Colombo, Walloon, and Kianga holdings, as well as in the vicinity of Moura, adjacent to the railway line to Theodore. Settlers who happen to have come from wheatgrowing areas in the South, as well as in Queensland, readily agree on this point, whilst not a few visitors to the settlement in recent years express a somewhat similar viewpoint.

Cotton and small-crop growing, together with dairying, will no doubt be the main objectives of the majority of the settlers for the first few years of the settlement's existence, but sooner or later large areas will be eagerly sought after and snapped up for wheatgrowing purposes, which, without a doubt, will result in the Theodore Settlement Area becoming one of the most successful in the history of irrigation projects in the Commonwealth.

I have no cause to change my viewpoint to-day in this connection, particularly after seeing what has been achieved by the Messrs. Letchford Brothers and a number of other wheatgrowing enthusiasts in both areas, and hearing further favourable expressions in this regard from other settlers.

Even sheep farming and the growing of fat lambs for market purposes could also become a profitable sideline in many instances, where conditions happened to be suitable and the required areas obtainable for the purpose. For both needs, however, a suitable crossbreed would be necessary if any degree of success were to be obtained, and in this respect I would not hesitate to recommend heavy-coated merino ewes and English Leicester rams. Dingoes would no doubt be a source of much annoyance and loss, of course, and the necessary precautions to combat the pest would have to be taken to ensure success.

Agricultural Notes.

By H. S. HUNTER, Agricultural Branch.

Seasonal Prospects.

AS a result of favourable seasonal conditions, the output of pastoral and agricultural products is being well maintained; prospects for the immediate future are encouraging from a production point of view, and the preparation of land for winter-growing crops can be carried out under suitable conditions. The chief disabilities confronting the primary producer continue to be those associated with marketing, in which field of activity problems have arisen which are claiming the attention of Governments in all countries.

Throughout the first four or five years of financial depression Queensland, as a whole, fortunately, has experienced reasonably good seasons. Although there have been short periods of dry weather, and more or less severe localised droughts in some districts, the State as a whole has not encountered, in the period referred to, any general drought such as has been experienced at recurring intervals in the past and, as a consequence, a high average of production has compensated in some degree for low market values.

The producer also has benefited from the operations of Marketing Boards operating under the State's marketing legislation. For products organised in this way, the producer invariably has secured a better price for his goods than his brother farmer in other States has been able to obtain. There are fifteen products, including sugar, which are subject to organised marketing in Queensland, the value of which is approximately £17,000,000 annually.

Wool.

Fortunately our principal revenue-producing industry, wool production, has risen from the rut. Prices have been well maintained at recent sales, ranging up to 23½d. for greasy and 41d. for scoured wool. An indication of the value to Australia of the improvement in wool prices is provided in the figures recently made available by the Commonwealth Department of Commerce, which show that the value of wool exported from Australia during the first seven months of the present financial year was £17,600,000 more than for the corresponding period of last year.

Wheat.

The wheat-growing industry is in a totally different position. Hitherto Australia, since the depression, has been enabled to clear all of her stocks, although at low values, mainly due to sales in the Eastern market, whereas most of the other wheat-exporting countries have been accumulating vast carry-over stocks. However, the quantity of wheat and flour shipped overseas from last season's crop, is equivalent to 26,000,000 bushels only, as compared with 52,000,000 bushels for a corresponding period in the preceding season. This falling off in exports has been attributed to large sales of wheat to China on long credit from the United States of America, and to heavy shipments of wheat to the East from the Argentine. Although Queensland is not a wheat-exporting State, local prices are influenced indirectly by export values.

Sugar.

The northern areas of the State experienced excessive rains during March; flood damage was occasioned in certain districts, while heavy winds resulted in lodging and damage to crops. As yet, the true extent of the loss is not ascertainable, and it is anticipated that the losses due to grubs will be much in excess of those of last year.

The areas south of Townsville have been favoured generally by conditions which make for continued growth, and the present indications are that the crop in these parts will exceed that of 1933.

Dairying.

Butter and cheese factories are maintaining a high output, but returns to producers are so low that hardship is caused in many cases. It is probable that within the course of a few weeks the new Australian stabilisation scheme will be put into operation. Agreements have been forwarded to the various factories for signing as a preliminary to the inauguration of the scheme, which is similar to the existing Queensland stabilisation scheme in that all factories will be required to bear their fair share of the less remunerative export market.

The advantage of the Australian-wide scheme is that, when it is in operation local prices for butter will not be influenced by fluctuations in butter prices on the London market.

The previous record for butter production in Queensland already has been eclipsed, and with a continuance of favourable conditions it is expected that the total production for the season will be in the vicinity of 2,000,000 boxes.

Maize.

Harvesting of the main maize crop now has commenced, the markets have been well supplied with new season's grain and prices have shown a further decline. For the first three weeks of March the maximum daily quotations averaged 2s. 4½d. per bushel. Excellent crops are reported in the Kingaroy district. In fact, all maize-growing areas of Southern Queensland will have unusually heavy crops, including the Darling Downs. It has been estimated that the Atherton Tableland crop will yield about 8,000 tons of grain.

Cotton.

Queensland's record crop of cotton is now being harvested, and the ginneries are working to full capacity. It has been found necessary to reopen the Gladstone ginnery—after it had been closed for a period of nine years—in order to deal with part of the crop. Arrangements have been made whereby it will be possible for about half of the crop to be absorbed by Australian spinners. Considerable interest is being evinced in the visit of the Minister for Customs who, at the time of writing, is visiting the cotton-growing areas.

Peanuts.

It is probable that the peanut yield also will constitute a record. About 9,000 acres have been planted to the crop, and seasonal conditions have favoured its development. The peanut is a crop of potential value as a rotational crop for tobacco lands and is now being experimented with for this purpose. About 200 acres have been planted with peanuts this season in the Mareeba tobacco district.

Since the removal of the embargo on foreign peanuts, the Tariff Board has conducted an inquiry into the industry, following on a request for an increase in Customs duty.

Tobacco.

Blue mould disease has been exceptionally prevalent in all tobacco-growing areas this season, and as a result growers have experienced great difficulty in raising seedlings in time for transplanting. In many instances transplanting was still progressing during the month, which is somewhat late for good results.

A considerable reduction in the area under tobacco is anticipated this season, owing to both disease and to the fact that a number of growers went out of the industry or planted smaller areas for various other reasons.

Although it is yet too early to make a reliable forecast of the probable acreage, it would appear from information received that the total area may not exceed 3,000 acres, as compared with approximately 8,000 acres last season.

NATURAL GRASSES AND THEIR REGENERATION.

Problems confronting the people who depend on Mitchell and Flinders grasses for the sustenance of their flocks and herds are to be investigated by the Department of Agriculture and Stock. The assistant botanist of the department (Mr. W. D. Francis) is about to leave on a special mission of inquiry in the Charleville district.

The Minister for Agriculture and Stock (Mr. F. W. Bulcock) announced recently that his department had given much attention to the regeneration of Mitchell grasses. Some inquiry also had been made in respect of Flinders grasses. The researches of Dr. E. Hirschfeld had been of great value, but reports were continually reaching the department to indicate conclusively the need for a wider range of inquiry in relation to both types of grasses.

Mitchell grass, added the Minister, was the standard natural grass of the best of the State's sheep areas, but complaints had been received recently that the Mitchell grass land was not regenerating from the continued drought in the way that it had in past years. Consequently, it had been decided to embark on a vigorous inquiry into this and allied problems. Mr. W. D. Francis would leave within a few days for Charleville to obtain information from station owners and others as to the regrowth made this season, following several years of drought. Local stock inspectors would co-operate with Mr. Francis.

In addition, a questionnaire had been distributed to all officers of the department and station managers within the Flinders and Mitchell grass areas. This sought information on the responsiveness of the grasses during the present season, and also asked for specimens, and any notes or information on different kinds of Flinders or Mitchell grass; also for details of any other grasses of outstanding value, particularly in relation to palatability and drought resistance; and concerning any herbs of outstanding merit associated with the grasses.

Mr. Bulcock said it was hoped by this means to collate valuable information, upon which would depend the nature of a survey to be embarked upon at a later date. He appealed to pastoralists to supply the required information. As evidence of the interest now being taken in the preservation of natural pastures, added Mr. Bulcock, one of the big Australian pastoral institutions was circularising the Australian Universities to obtain the services of a graduate to study inland pastures.

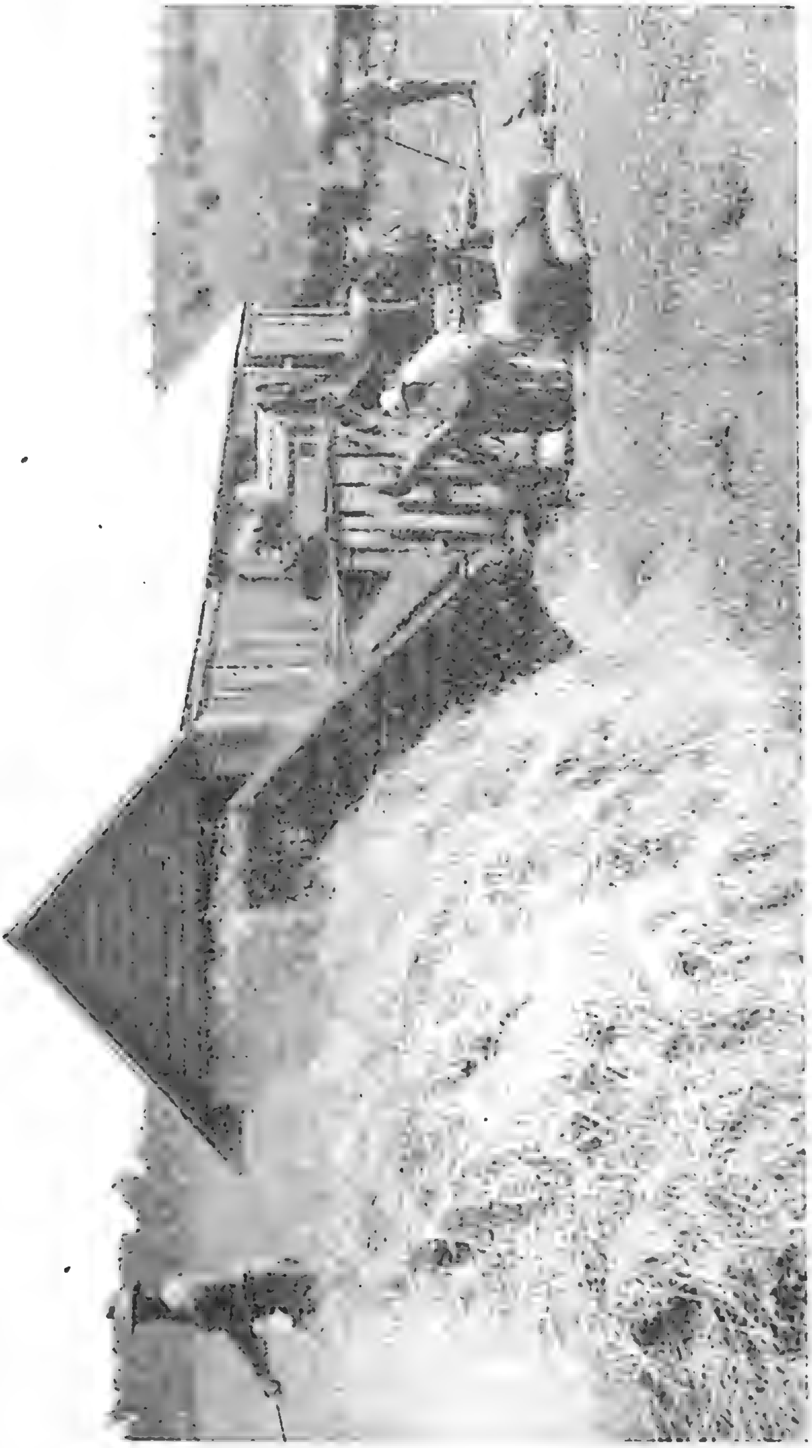

Plate 116.

Thrashing Oats on Mr. C. F. Adermann's Farm, Kingaroy.

Photo. by courtesy of the "Courier-Mail."]

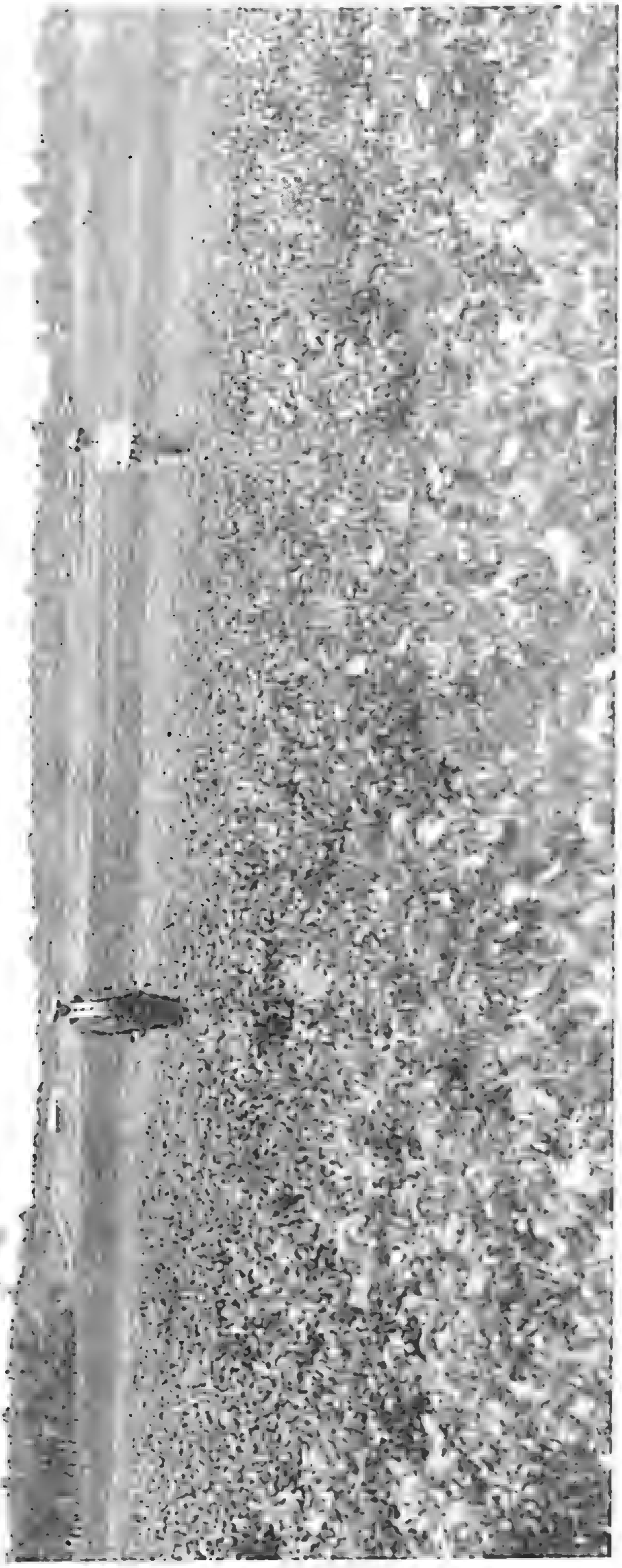

PLATE 117.

A field of peanuts on Mr. L. V. Young's farm, Wooroolin.

By courtesy of the "Courier-Mail."

Plywood and Veneer Industry.

FORMATION OF MARKETING BOARD.

THE Minister for Agriculture (Hon. F. W. Bulcock) announced recently that the Government had decided on the formation of a marketing board to control the Queensland plywood and veneer industry. This decision, said Mr. Bulcock, followed an application made by the Plywood Manufacturers' Association of this State, which had been supported by deputations and representations from all South Queensland factories, with one exception.

The plywood industry is an important one for Queensland as it is in this State that most of the Australian production of plywood and veneers from native timbers is manufactured.

The capital invested in the industry in Queensland is in the neighbourhood of £350,000. Last year it used 8,000,000 super. feet of hoop pine logs of a value of £90,000 delivered at factories, and gave employment to over 400 hands, with a total pay-roll of £1,600 per week when all mills are working, in addition to the work afforded in cutting, hauling, loading, railage, cartage, and shipping. The production of plywood by South Queensland factories during last year was approximately 32,000,000 square feet of a value of over £200,000.

Possibility of Increased Employment.

Whilst these figures speak for themselves, the Minister said that even on the present capital invested a considerably increased production is possible. Many plants are capable of a much greater annual output, if markets are available, and it is estimated that the existing factories could increase their production to 50,000,000 square feet per annum. Were such an objective realised the increased employment afforded would be obvious.

The industry has represented to the Government that what principally hampers the attainment of this objective is the fact that, through fierce competition among themselves, it has not been possible to exploit new markets and new uses to the fullest extent. Failing to secure absolute unanimity the manufacturers approached the Government for the formation of a pool under the Primary Producers' Organisation and Marketing Acts.

Other Advantages.

The Government has made a careful inquiry into the application and has found that organisation of the industry could, in addition to affording the opportunity of increased employment, have other advantages in that orderly marketing of the product for both Australian and overseas markets could be assured; the undue competition which has been detrimental to the industry and the State could be eliminated; the prices could be fixed in such a way as to protect the interests of both consumer and manufacturer and of the Government as the owner of the principal supplies of raw material, and bring about stability and continuous employment in the industry; the use of new woods and methods could be investigated thus more firmly establishing the life of the industry; standards and gradings of veneers and plywood

could be fixed with a view to improvement; and last, but not least, considerable work could be done in securing new markets for Queensland plywood.

"Having regard to all these facts," said Mr. Bulcock, "it appeared to the Government that it is imperative that some steps should be taken to lift the industry from its present disorganised condition, which is not in the best interests of the State generally, and after due consideration the formation of a Plywood and Veneers Marketing Board has been approved."

Public Interests Protected.

To protect the interests of the public, it is proposed to include on the board representatives of the Department of Agriculture and of the Forestry Sub-department. The proposed board, when constituted, will apply to South Queensland only; its functions not extending beyond the 23rd parallel.

"It is worthy of note," concluded the Minister, "that this is the first time in Australia that a marketing board has been appointed to control plywood and veneers, and is significant of the progressiveness of the policy of this Government in assisting in the orderly and stabilised manufacture and marketing of Queensland's raw materials—a policy in keeping with modern trend in administration the world over."

WHEAT AS STOCK FOOD.

The relatively large quantity of the current season's crop which is weather damaged, coupled with the low price ruling for even the best wheat, opens up a question whether more grain cannot be used as stock feed.

An average sample of wheat possesses the same protein content as oats, and rather more than maize. It is richer in carbohydrates than either oats or maize, but is relatively deficient in fats. This deficiency of oil or fat renders the grain less palatable to stock and less readily mixed with the saliva, whereby the digestibility of the grain is to some extent adversely affected. In a non-ruminating animal such as a horse, where the stomach is simple and of relatively small capacity, the proper mastication and mixing of food with saliva before swallowing is of importance if the digestion is to be saved. Ruminants, on the other hand, are in a better position to deal satisfactorily with the grain on account of the preparation which it undergoes in the process of chewing the cud before entering the fourth or true stomach.

Wheat may, nevertheless, be fed to horses with advantage and safety if discretion is exercised in its use, and it is first ground or rolled. It should be fed in moderate quantities, up to 7 or 8 lb. per day, and mixed with some bulky material such as bran or chaff. When it is desired to change horses over from oats to wheat, the change should be made gradually in order to allow the animal's digestive organs to become accustomed to the new diet.

Experiments conducted in various countries show that wheat can be fed to dairy cows with profit when mixed with other foods. A good meal mixture can be prepared as follows:—4 parts ground wheat, 1 part bran, 1 part linseed meal.

As portion of the ration for fattening cattle, wheat has given better results than oats.

Sheep will do well on wheat, which is better fed whole. In America it is considered slightly superior to maize, but experience in Australia shows that maize gives a somewhat better result. That, however, may be accounted for by the fact that grain is usually fed to sheep from the ground, and not from troughing. Wheat being so much smaller than maize, a certain amount of earth is picked up with it when feeding, to the detriment of the diet.

At least one Riverina farmer has proved it good business to feed wheat to pigs rather than accept anything below 3s. a bushel for the grain. His practice is to crush the wheat and feed it to the pigs through a self-regulating hopper erected in the yard. The pigs have access to plenty of water and fatten rapidly.—"The Pastoral Review."

The Conquest of Climate.

By R. W. CILENTO, M.D., B.S. (Adelaide), D.T.M. and H. (England), Senior Medical Officer, Commonwealth Department of Health, Canberra, F.T.

Subjoined are extracts from the Anne Mackenzie Oration delivered by Dr. Cilento at the Institute of Anatomy, Canberra, on 1st March, 1933. In view of the national importance of extending settlement within our tropical territory, Dr. Cilento's oration, a valuable contribution to current thought on the subject, is of great interest to not only Queensland residents north of Capricorn, but also to everyone concerned with the future of our race and the preservation of the White Australia ideal.—Ed.

MAN'S real ability to bear any extreme of temperature, altitude, rainfall *et cetera,* though often denied, is demonstrated by everyday experience. Lucien Lefèbvre, in the delightful work to which I am indebted for many of my examples, in developing the theme that man deliberately sets Nature at defiance, says:

> Can we talk of heat and cold—sheer heat and sheer cold, so to speak? Geographies generally agree to place the "pole of cold" at Verkhoyansk in Siberia; and it is a fact that of the three poles of cold which Mohn recognises in the Northern hemisphere, in his account of the meteorological results of Nansen's Polar Expedition (Eastern Siberia, Central Greenland, and the Polar Region properly so called), Siberia is the chief and the most accentuated. But Verkhoyansk, which is included in it, is an inhabited place, with a population of 356, according to the latest census, and the soil there is sown and cultivated every year: indeed, human families live and multiply there under conditions which are elsewhere considered prohibitive, for the January mean is –51.2 degrees. Inversely, Massowah on the Red Sea, in the middle of a stifling coastal plain, combines all the extreme conditions of heat which our meteorological treatises define, and is, notwithstanding, regularly inhabited (population 7,000) . . . Another series of meteorological phenomena has to be considered: the restrictive action of the barometric pressure is well known and evident. Men can work but little, and that with difficulty, under too low a pressure, but this did not prevent the making of a railway in Peru at a height of 13,000 ft.; nor the working of sulphur mines on Popacatepetl, at 17,800 ft. A road has been made at a height of 18,500 ft. in the Karakorum; and, lastly, 17 per cent. of all the towns in Bolivia are situated at a height of over 13,000 ft. In Southern Thibet mountain sickness is felt by travellers, at times very seriously, at an altitude of 12,000 to 15,000 ft.; but Shigatse is a town 12,740 ft. high, and Gyangtse stands at 13,000 ft., where a July temperature of 105 degrees has been recorded, whilst from September onward it freezes, and night temperatures of –16 degrees are frequent and even normal in winter.

Woeikof points out that half the human race (806 millions) lives between the 20th and the 40th degrees of north latitude, that is to say, in that very belt of land so often condemned, which is nearer the equator than any part of Europe whatever, and contains, moreover, the greater part of all the deserts in the northern hemisphere. The areas classed as "desert" or "semi-desert," that is to say, those that receive less than 20 inches of rain in the year, actually form altogether three-fifths of all the land above sea level. And they are by no means negligible countries (a matter of immense importance to Australia, since a great part of our own area comes under that category); it was precisely in those desert and semi-desert areas that there arose, without exception, the ancient civilisations, both of the old and the new world.

Time does not permit me to refer in any detail to those great chapters in the mighty story of civilisation, and I regret it, because our education persistently ignores them, to concentrate upon the age of Pericles, from which we draw our civilisation, as though its splendour blotted out the equal grandeur of its predecessors.

To us, the Golden Age of Greece, as the source and origin of our own intellectual ascendancy, is the beginning of civilisation; as a matter of fact, it was the end product of all the mighty civilisations that had gone before it, not a few of which had transcended it, including that ancient Egypt that could declare to Solon that the Greeks, in their heyday, were "mere children, loud-mouthed and vain, with no knowledge of the past"; including the civilisation of India; and including those great empires that had repeatedly arisen in Asia Minor.

From time immemorial the Chinese were famous navigators. It is said that as early as A.D. 121 they had invented the compass and sailed the seas from the Persian Gulf to Canton, and from the Malay Peninsula to Australia, New Guinea, and the Philippines, in great junks capable of holding 600 to 700 men, so that the greatest part of the known world looked to China as "Mistress of the Seas." (Some months ago, many feet beneath the surface of a newly discovered gold mine in New Guinea, Australian miners were amazed to find a Chinese bell, one of the trade symbols of their age-long search for pearls and gold. At Port Darwin years ago, excavations for road building in virgin country revealed a Chinese plaque several feet beneath the roots of an enormous banyan, itself a foreign tree.)

Reaching the zenith of her civilisation before ours even began, China declined as a world power after the revolution of A.D. 878, when the foreign merchants were massacred or expelled (was it because they brought epidemic plagues in their ships?) and Chinese voyagers were rigorously restricted to the neighbouring shores. It was not until the thirteenth century that the Mongol invasion once more dragged her from her self-sought isolation into the great maelstrom of world commerce.

As for India, Mookerji points out that—

> For three centuries India stood out as the very heart of the Old World and maintained her position as one of the foremost maritime countries. She had colonies in Pegu, in Cambodia, in Java, in Sumatra, in Borneo, and even in the countries of the further East, such as Japan. She had trading settlements in South China, in the Malayan Peninsula, in Arabia, and in all the chief cities of Persia, and all over the East coast of Africa. . . . During the first few centuries of the Christian era an enthusiastic band of devoted Bengalis, burning with a proselytizing zeal, went so far as China, Korea, and Japan, carrying with them the torch of Buddhistic faith.

Her influence and dominions spread right through the Indonesian chain above our shores, where Chinese had preceded them and Arabs were to follow (and where, indeed, in the Torres Straits, by some dim chance, Egyptians had left the detailed processes of mummification as used in Egypt in the twenty-first dynasty, to be the burial practice of a savage native tribe on Darnley Island).

The Hindus excelled all the nations of antiquity in operative surgery and four hundred years before Christ they had highly developed medical and sanitary systems and public hospitals. Malaria was known and attributed to mosquitoes, a discovery remade by Ross less than

forty years ago; the recently recognised association of rats with plague was observed and recorded; and several other diseases of recent investigation, as, for example, diabetes, were, we are told by Garrison and Jolly, recognised and dealt with. Their methods of operating for cataract, skin grafting, and certain other procedures were adopted into present-day European medicine, and they have provided us with numerous effective drugs for our pharmacopœia.

Apart from these civilisations, we often forget that there is no direct descent between ancient Greece and modern Europe. . . .

It was not until the Arabs from the deserts of Asia Minor burst through the Dardanelles that the learning that had stagnated for a thousand years broke into belated flower. The amazing rise of Europe was to that epoch what the rise of Japan has been to this.

But meanwhile, for a period as long as that during which Great Britain has been a world power, and considerably longer than that during which the United States of America has been in existence, the burning sands of Asia Minor and Africa bred a race of warriors, scientists, and missionaries equal to any later series.

The religion of Mohammed aimed at the conquest of the world, and in less than a century it had actually conquered the world from the Atlantic to the Himalayas and, we are told, but for the sudden death of a caliph, would probably have extended its sway to the Pacific. As Beazley says—

The last of the Ommiades (A.D. 750) reigned over three-quarters of the empire of Alexander and a quarter of the dominion of Trajan . . . No race has ever shown a greater keenness for the acquisition of knowledge or more favour to the growth of science.

Arnold Wood has added that—

While Europe sat in darkness, Baghdad became the centre of a splendid civilisation.

In the ninth century the Greek and Roman classics had already been translated into Arabic and had become the inspiration of native Arab scientists, who in their turn, though not until four hundred years later, became the teachers and masters of Christian scholars like Roger Bacon.

Arabian travellers co-operated with Arabian men of science and surveyed every sea from Spain to China, from Cairo to Madagascar, from Java to Canton. Arabian merchants traded and colonised on the east coast of Africa, on the west coast of India, in Sumatra, in Java, and in China. Immediately north of Australia's shores is a little island, west of the Philippines, in the Pelew group, which in its Arabic name of Bab-el-thaob, or "Gateway of the East," demonstrates the far-flung limits of the Moslem power. Well might Sir William Hunter write that "the Indian Ocean became an outlying domain of Islam."

When one turns unbiased attention to these other civilisations which now seem so remote—and perhaps in their remoteness and in our ignorance somewhat trivial—it is difficult, but essential, to realise that it is only six hundred years since the Europe of to-day began to rise from the chaos of semi-civilisation; that it is less than three hundred years since England became a first-class power; and that at that golden age of Greek dominance from which we trace the very phrases, ideas, and habits of thought that mould so much of our public policy, and colour so much of our national outlook, Britain, and indeed all north-west Europe, was primitive to the stage of sordid misery.

The climate has not changed in this tiny section of history. To regard it as the causative factor in Great Britain's rise to power is obviously ludicrous.

To what, then, is due the present eminence of the Anglo-Saxon race, British and American, with its colonies and dominions in every continent?

Every human factor is complex, but to this question we must answer in all humility that one very large element at least was the rounding of the Cape of Good Hope by Vasco da Gama, a Portuguese, and the discovery of America by Columbus, an Italian sailor in the service of Spain.

British history may be said to have begun when those discoveries produced the maritime revolution that closed the middle ages, the revolution that transferred the centre of world politics from the Mediterranean to the Atlantic, effectively and finally checkmating the Mediterranean nations which had monopolised trade with the East through that land-locked sea, and the Moslem, who, by his possession of Asia Minor, had cut the whole of Europe off from the Indian Ocean. Britain, as isolated as Australia, became suddenly the ideal seat and centre for the Atlantic trade, and in one century (and without, mark you, any change of climate) sprang from obscurity to the status of a first-class power.

With trade came wealth, with wealth came food, and with food, health.

There is a whimsical parallel and contrast between ancient Britain and the Australia of 1788, as we know them from contemporary authors.

Australia, we were assured, was one of the poorest of countries, isolated "for ever" from centres of trade, with no natural fruits, with no animals but the dingo and the kangaroo, with a summer climate that was intolerable, and with a vegetation that was no more than a vast monotony of grey-green gums, interspersed with dreary swamps and miles of drab scrub; above all, said the critics, was a fierce sun in a brazen sky, with blinding sunlight and a parched soil never moistened by rain.

The Britain of two thousand years ago was utterly unlike the ideal Britain of our tradition or the man-made gem of to-day. It was, as Vergil said, isolated "for ever" from civilisation by rough seas; it had no fruits but the bitter and uneatable crab apple, and no animals but the wolf. It had great areas of dreary swamp and fen, and a winter climate that the hardy Roman soldiers dreaded worse than death. As for the vegetation, throughout all Europe it was no more than a dreadful monotony of beech, elm, chestnut and oak, that from the northern slopes of the Alps to Ultima Thule buried the country beneath a grey-green pall, rendered ever more melancholy by the lowering skies, the utter sunlessness and the perpetual dripping of the endless rains that soaked its sour soil.

And what of it to-day?

As Emerson says—

England is a garden. Under an ash-coloured sky the fields have been combed and rolled till they appear to have been finished with a pencil instead of a plough. The solidity of the structures that compose the towns speaks the industry of ages. Nothing is left as it was made. Rivers, hills, valleys, the sea itself, feel the hand of a master. The long habitation of a powerful and industrious race has turned every

rood of land to its best use, has found all the capabilities, the arable soil, the quarriable rock, the highways, the byways, the fords, the navigable waters; and the new arts of intercourse meet you everywhere; so that England is a huge phalanstery where all that man wants is provided within the precinct.

What wrought this change in what had been that age-old monotony of beech and oak: Nature, or man setting Nature at defiance?

The story of the human will and human industry that have extended the vegetation of the tropics and the semi-tropics to redeem the colder reaches of the earth from their barren bleakness, is the main theme of civilisation.

The ancient Pharaohs took advantage of their foreign expeditions to introduce exotic plants into Egypt, and were so well aware of the glory due to men who bettered or outwitted Nature that they took to themselves for so doing titles of honour, that we still may read inscribed on their ancient monuments.

By systematic and studied acclimatisation they collected within their country from Western Asia an enormous quantity of plants for food, for industry, and for pleasure, and distributed them, moreover, to all their allies and neighbours. Upon the naturally rugged coasts of a Mediterranean we have never known they grafted that artificial landscape we regard as "typical of Southern Europe." Can you imagine an Italy bare of the olive, the vine, the oleander, the cypress, the plane tree, the lemon, the orange, the almond, the peach, and the mulberry? Yet so it was until Egypt remade it. To all these the Romans added from their conquest the apricot and the pomegranate, among a host of lesser fruits and flowers, and from Italy they carried their fruits to enrich and remodel all Western Europe as far as the Rhine and the Danube, grafting fragments of a new kind of country—a new kind of climate—on natural areas whose disparity with them was complete. In its new French homes, for example (and in spite of the prophecies inspired by that pessimistic conservatism that seems inseparable then, as now, from the academic-minded), the vine flourished so exceedingly everywhere that in the middle ages a canton of Toulon-sur-Arroux "took its name (Sanvignes) from its almost unique incapacity to nourish that plant of hot climates" (Lefèbvre).

The olive similarly, foreign to both Italy and Africa until two centuries after the foundation of Rome, had been naturalised there so successfully that it became the commonest of fruits and now was carried "with painful care into Spain and Gaul" (Gibbon).

Flax, too, was transported to Gaul from Egypt, and enriched the whole country; and the use of artificial grasses, including in particular lucerne (which came originally from Media in Asia Minor), became a familiar boon to European farmers.

In Britain, however, up to the end of the middle ages, the process was rudimentary and famine always followed a bad harvest. During the winter there was not enough pasture for the flocks, and it was the custom to kill and salt, smoke or dry the flesh of all but the best beasts. Even so, the people's ration was so meagre that scurvy was appallingly rife. The introduction of new fruits, vegetables, and fodders from abroad—the most permanent of the "fruits of conquest"—came with the maritime revolution and England's consequent rise to world power. To the curious student her importations set her former poverty in high

relief. Plimmer points out, for example, that the use of greens and salads was introduced only by Catherine of Aragon, wife of Henry VIII., and that, as the English were ignorant of the growing of greens, she was forced to import a gardener from Holland, where possibly the people had learned the art while subject to Spain.

The potato, so important a factor in our everyday life, was brought to England from its home in the dry Andes of South America in 1565 (and incidentally was regarded at the outset with indignant hostility as "unchristian" pig food); while the planting of root crops, such as the turnip, dates only from the middle of the seventeenth century.

Custom turns a casual corner and civilisations rise or fall.

Osborne, commenting on the decline of Rome, once pointed out that no description of the causes that bore down that mightiest of empires was complete if it omitted "Baltic herring and Egyptian wheat." No history of the rise of Great Britain is perfect if it omit the introduction of the foods that permited her flocks and herds to be carried safely through the winter and added to the diet of her people those elements that foster vigour and initiative. For 3,000 years the potent British stocks lay latent in an obscure island; in three hundred they overran the whole globe.

When, less than a century ago, the microscope conquered superstition, science found the Anglo-Saxon in every climate clinging grimly to half the world. The coloured races of the tropical lands laid luxurious tributes at the feet of their new lords, and the diseases rife in their new dominions struck them down in thousands as they took them up.

In the West Indies, for example, 3,000 white men died in one small island in one year; and in Africa and in India the record was no less dreadful. It is recorded that a King's ship "Tiger," cruising on duty off the Barbadoes, out of a crew of originally 220, lost 600 men from yellow fever in two years, the master of the vessel, as he reported, "still pressing men out of merchant ships that come in, to recruit my number in the room of those who died daily."

The lot of the soldier in India makes startling reading. Statistics are out of place perhaps in a lay oration, but you will permit me a moment's latitude to take you back a century. From 1832 to 1838, inclusive, in Fort William, India, out of every 1,000 soldiers there were 1,883 admissions to hospital every year, and the annual deaths were seventy-three. At Chinsurah depôt, 12 miles from Calcutta, from 1826 to 1837, of every 1,000 of the troops there were 1,930 admissions to hospital, with 73.7 deaths annually. That was the mortality on the spot only, and does not include the invalids who died on the passage to England or shortly after their arrival there; these were sufficient to bring the deaths to more than eighty per 1,000 annually. As service in India is permanent, or, rather, leave of absence was allowed to those who chose to return to Europe for three years after ten to fifteen years of service, it will be noted that in the tenth year less than two hundred would survive out of every 1,000 soldiers sent to India.

And what were the diseases? They were diseases that at the present day are almost wholly preventible. Out of every 1,000 soldiers dying in Bengal, Burke stated that 268 died from "fever," 378 died from bowel complaints and liver abscesses, 195 died from cholera, 46

died from tuberculosis or other respiratory diseases, leaving a meagre total of 110 in every 1,000 to die from every other kind of disease whatever.

I have already referred briefly to the fact that as recently as the girlhood of Anne MacKenzie it was commonly accepted that the causes of epidemic fevers and diseases were either cosmic, atmospheric influences, or miasms from " the bowels of the earth"; that the localisation of particular forms of disease was supposed to be due to "local peculiarities" of men and climates; and that, as William Stokes (1804-1878), following Sydenham, asserted, diseases were not specific and separate but that "the same exciting cause is capable of producing different kinds of fever in different persons."

Since no distinction was known between fevers, except the mere fact of locality, all were treated alike, and the death rate was enormous. The treatment was directed towards expelling the supposed evil matter, and was as follows:—First, repeated bleeding, 25 to 50 oz. of blood being withdrawn (and many a patient was bled to death, as is obvious from the case notes); secondly, violent purgation; thirdly, cold and tepid affusions; fourthly, mercury, pressed to the point of poisoning and the production of salivation; fifthly, violent emetics were used to reinforce the effect of violent purges (though this was passing out of favour); and sixthly, diaphoretics were used to "sweat the poison from the body," to use the present day phrase of the man in the street. In the last stage of treatment tonics and stimulants, including quinine bark, wine, and opium, might be employed.

The only drug valuable in malaria—and malaria must have represented a very great proportion of all the cases—is mentioned in one word on one page in an account of the treatment of fevers that traverses nine pages of close print. It is not otherwise referred to, except in condemnation, in Johnson and Martin's standard text-book of 1841, though Johnson states that, on account of the variability in symptoms seen, he "shall not attempt to deny that there may be cases wherein the the use of wine, and even bark (quinine) is indispensable."

Into this tragic confusion came the microscope, a magic index of bacteria and parasites, that steadily and rapidly dispersed that comfortable smoke screen of ignorance, "climate," replacing it by clear pictures of visible causes.

As early as 1546 Fracastorius, a famous Italian doctor, had, so Garrison tells us, described contagion as being due to "*seminaria contagionum*"—germs—that were able to grow and multiply; and had quite clearly expounded the relation between infection and epidemics. Nevertheless, it was only between 1870 and 1900 that a series of brilliant successes decided the struggle between science and the speculative philosophy that had usurped the throne of scientific observation.

In 1872 Lewis in India discovered that the micro-filaria lived normally in the blood of persons infected with filariasis and the fever that accompanied it; in 1873 Obermeier saw first the spirochæte that is the essential cause of relapsing fever; and in 1874 Hansen demonstrated the bacillus of leprosy. In 1878 Manson, the "Father of Tropical Medicine," found that a mosquito, an insect vector, was the indispensable carrier that conveyed filariasis from man to man. He had effected a revolution in medical thought.

From 1880 to 1894 there were determined, among other things, the causative organisms of suppuration, typhoid fever (1880), malaria (1880), glanders (1882), tuberculosis (1882), cholera (1883), diphtheria (1883-4), tetanus (1884), undulant (Malta) fever (1887), cerebro-spinal meningitis (1887), and plague (1894); and man, running hot-foot in the sudden consciousness of victory, soon discovered how to outwit Nature by protective inoculation against anthrax, tetanus, hydrophobia, cholera, diphtheria, and typhoid.

Three years later (1897), Shiga and Kruse had detected the germ cause of bacillary dysentery, and Tictin had found that relapsing fever was conveyed by the bed bug, the louse and the tick being incriminated also later. But in that year (1897-8) Ronald Ross, on Manson's advice, and with his encouragement, finally demonstrated the rôle of the mosquito in the transmission of malaria, and for the first time laid down the measures that would ultimately vanquish that "principal and gigantic ally of barbarism."

The microscope revealed and classified ever-increasing numbers of parasites from the blood, the body tissues, the urine, and the bowel contents; while in the laboratories scientists grew on culture media the "demons that produced corruption of the air and pestilences" and bottled in test tubes the different organisms whose varying effects on the human body had been ascribed to "differences due to climate."

Thus, in the short span of thirty years, climate was absolved from the burden of guilt it had borne unjustly for thirty long centuries.

In the tropics the effect of this new lead in scientific thought was enormous. With the development of national greatness social standards had so improved in Great Britain during the previous two hundred years that the commoner epidemic plagues had largely disappeared; leprosy had gone with the middle ages, plague disappeared after 1680, malaria was increasingly rare, and cholera only an occasional dreaded visitant. But among the teeming poor of the rich and populous East, the most fatal plagues were still so common that, forgetting Europe's former subjection to these same scourges, they were called "tropical diseases." I must emphasise that point.

Many diseases called "tropical" are merely diseases which have their greatest distribution where social and sanitary conditions are primitive, or grossly defective, and nowhere is this the case more than in the tropics. Plague, cholera, typhus, smallpox, dysentery, leprosy, and malaria have all raged at times in Europe and were only recently controlled, some foci still existing. It was in the tropics, however, that they were rampant, and it is to the tropics that we look for those victories to which each year adds new examples.

Moreover, as Manson long ago pointed out, heat and moisture are responsible for an amazing fertility in tropical countries—in men, in animals, and in plants; and this applies equally to bacteria, parasites, and the insects that act as their vectors. Since the fly, the tick, the mite, and their more scandalous colleagues, the flea, the bed bug, and the louse, have been found equally guilty with the mosquito as porters of disease, it is obvious that in the areas of their greatest prevalence, and earth's greatest profusion, man must fight this grimmest battle for survival.

Before Hercules may win the golden apples of the Hesperides and the delights of Olympus, he still must overcome the fiery dragon that guards the tree and the many-headed Lernean hydra of the swamp.

Here, perhaps, we may spare a crumb to the protagonists of climate and set it in its true perspective, for here, perhaps, is that grain of fact in a bushel of fiction that led the world in its ignorance to set all diseases at its door. Newsholme points out that:—

In England mild winters and cool summers lower the death rate, the former by decreasing catarrhal infections, and the latter especially by reducing the prevalence of diarrhœa. Hot and dry summers favour the occurrence not only of fatal diarrhœa in the summer, but also of enteric fever in the autumn of the same year. But recent experience shows that hygienic measures are competent to reduce or even to annihilate any excess of these diseases favoured by climatic conditions. Typhus fever and smallpox prevail chiefly in the winter and spring; but they are completely avoidable at all seasons. Pneumonia is much more prevalent and fatal after a cold snap accompanied by fog; and this has been ascribed to the absence of sunshine; the chief agent in causing this result, however, is the low temperature, affecting in particular those of extremes of age, with lowered vitality. Differences of prevalence of disease associated with climatic differences are well known, as, for instance, in rheumatic fever, scarlet fever, diphtheria, and tuberculosis; but in most instances—and still more is this true for the tropical parasitic diseases—the difference is controllable.

Newsholme might have added that the warmth and moisture of the tropics are essential to the presence of the hookworm—that great devitalising factor in native (and even white) communities—a disease that is the only present threat to white colonisation in tropical Queensland (where, up to the withdrawal of the Commonwealth last year from the campaign for control, it had already cost the country £180,000).

Cholera in India has been found by Rogers to be able to reach epidemic proportions only when the degree of atmospheric humidity has reached a certain figure; yellow fever in Central America requires for its development in epidemic form a mean atmospheric temperature of 75 degrees F., and will not spread below it. It is favoured by damp and stopped by cold. Martin and Bacot, in India, demonstrated that the duration of life of *X. cheopis* when fasting was determined by saturation deficiency, and Rogers recently called attention to the fact that a low saturation deficiency meant a high incidence of plague and a high saturation deficiency a low incidence. On all such information forecasts of epidemic probability can be made in these and in other diseases, for investigators, with patience and skill, have determined an infinite number of other minute differences in the life history of parasites and their insect vectors, upon which, to an extent undreamt of, depend the effective implantation, the endemicity, or the epidemic spread of various diseases.

This, then, is the new trend of medical and scientific thought that I present to you. How can we best apply it?

Newsholme answered the query when he said that there is always some controllable aspect of the case; in the tropics this is not only true, but it is the basic problem of progress.

Unless the administrations of tropical countries make health everything, disease makes them nothing.

Time permits me only the briefest illustrations. Nicholls has shown how surely the former civilisation of Ceylon that spread its magnificent monuments from that island throughout the Indonesian chain above our

shores, was destroyed a thousand years ago by the malaria and the hook-worm disease that still flourish triumphantly among their ruins; Jones has demonstrated the rôle of malaria in the fall of Greece and of Rome; the history of India is one long catalogue of such disasters; and in the earlier days of South and Central America the white man was repeatedly pushed from his supremacy by yellow fever. Every kind of explanation has been advanced by arm-chair speculation to account for the patchy distribution of the Polynesian and Melanesian races here in Oceania—skin colour, climate, ocean currents, and a dozen others—but it is perfectly obvious that it is the absence or presence of malaria that has determined the local survival or extinction of the Polynesian.

I have chosen Indonesia and Oceania as examples because the factors operative may be studied in the island chains that bound our shores from Java to Fiji, and because one example is the story of the ruin of a great civilisation and the other is largely the explanation of the barren history of New Guinea.

In the great Melanesian chain, in a climate that will grow in profusion almost every tropical product, we are amazed to find primitive and undeveloped tribes on whose shores the successive waves of eastern and western civilisations have spent themselves in vain since the dawn of history. Perhaps nowhere is there a better illustration to-day of the blind brutality with which disease factors and food deficiencies together chain man down to mere animal existence.

The reference to food deficiencies recalls the recent triumphs in the field of dietetics.

Just as the outstanding achievement of last generation was the isolation of the specific bacteria that caused epidemic disease, so the research in this generation that has most seized the attention of the public is the discovery of the unsuspectedly intimate association that exists between food and health. No one now doubts the relation of scurvy, beri beri, and rickets to the lack of some essential constituents in the diet, or denies the existence of the substances called vitamins. But researches into nutrition have demonstrated, even more importantly, that, apart from the prevention of frank disease, a balanced and adequate diet is essential to the vitality of mankind, with all that that implies in fertility, resistance, manliness, energy, and initiative.

Thus McCollum and Simmonds assert with conviction that, short of producing obvious disease, an improperly constituted diet is an important cause of—

> Inferiority in physical development, instability of the nervous system, lack of recuperative power and endurance, with consequent cumulative fatigue; and lack of resistance to infections such as tuberculosis, and other types where specific immunity is not easily developed by the body. In addition to these, the rate of development of senile characteristics and consequently the length of the span of life are greatly influenced by the type of diet to which one adheres.

In New Guinea these hypotheses are amply confirmed not only so far as the natives are concerned, but also among those white men who live on tinned foods. Food deficiencies double all hospital costs; and, indeed, all overhead expenses, by enormously diminishing the efficiency of labour.

How could it be otherwise with the natives at least, whose diet in their own villages, even at its best, is bulky, innutritious, and deficient in fat and in protein, hard to digest with its 15 per cent. to 50 per cent.

of contained fibre, and poor in vitamins A and C? At its best its deficiencies are made up for the more powerful members of the tribe by the growing shoots of plants, certain seedy grasses, ferns and fruits, with the raw liver of fish, or, rarely, of animals, formerly even of men. At its worst it is a compromise with famine, and not always a successful one.

With endemic diseases that prevent all but a minimal foraging for food or cultivation of the soil, and with a consequently faulty diet that still further lowers bodily resistance to those very diseases, is it any wonder that the native often reaches a stalemate, where initiative and industry are lost in the mere struggle for survival?

Nor does the coming of the white man aid him at the outset. The first impact of civilisation is actually to intensify native disabilities, for in New Guinea, it introduced tuberculosis, dysentery, and venereal disease; while disruption of the social organisation of native communities and the introduction of plant pests still further limited foodstuffs. Nevertheless, if we will use them, we can to-day lay the whole world under tribute to redress the balance, for both the diseases and the deficiencies are controllable, though admittedly control is a complex problem.

It is the conquest of environment, and is not this what I called just now the main theme of civilisation? Should not, is not, the whole fabric of social progress built about the co-operation of the producer, the defender, and the equitable distributor of work and wealth, or, as one may more aptly put it for a subject native province threatened with disease and famine, the co-operation of the medical man, the agriculturist, and the anthropologist?

The basic problem in every native community is the problem of health, and medical science has won many victories since Manson, Ross, Reed, Bruce, Rogers, and a host of others brought promise out of chaos. One can do no more than mention the progress that has been made in the control of malaria, hookworm disease, smallpox, plague, cholera, dysentery, relapsing fever, typhus, leprosy, and a host of others. Schistosomiasis yields to the antimony treatment elaborated by Christopherson, while the work of Leiper and others has shown that the parasite develops in water snails vulnerable to attack. Kala azar, which often decimated the richer populated tracts of Bengal and Assam, killing 90 per cent. of those it attacked, has in the last few years succumbed also to the curative properties of intravenously administered antimony. There is the greatest promise in the success that has been secured in the treatment of sprue by lessons learned in the special field of endocrinology. Cholera and plague may now be rapidly stayed by prophylactic vaccines, while the epidemic distribution of the former may be anticipated with certainty and prevented by adequate measures; and rat control and examination are a sound check on the latter. Emetin and other products have enormously reduced the ravages of amœbic dysentery while synthetic chemistry continually adds to the resources available to the physician in the treatment of almost every tropical disorder.

In the field of plant life the endless story of beneficent interchange between the tropical and the temperate regions goes on unceasingly.

I have referred previously to the part Egypt played in remoulding the countries of the Mediterranean from the rich plant life of Western

Asia; to the dissemination throughout all Europe of those benefits by the Roman conquests; and to the continual additions that have varied life, ameliorated hardship, and multiplied resources since the great tropical areas of the old and new worlds were thrown open by explorers and traders.

In the last 300 years, and especially in the last century, our dependence upon the tropics has grown to an enormous extent—an extent that is masked by long every-day familiarity. We draw on the tropics for such common articles as our indispensable beverages—tea, coffe, and cocoa; the coconut oil that produces many of our soaps, the tung oil that blends the paints of our houses, and all kinds of fibres of industrial importance, such as sisal-hemp, cotton, silk, jute, kapok, and so on. From the tropics we have obtained hundreds of medicinal drugs, spices, aromatics, and dyes, as, to give the first examples that occur to me, quinine, castor oil, ipecacuanha, quassia, strophanthus, ephedrine, chrysarobin, chaulmoogra oil, and camphor; sugar, pepper, nutmeg, cloves, cinnamon, cochineal, coconut, and curry powder. The veneer woods of the tropics are general in our homes, and fruits such as bananas, pineapples, and dates are common on our tables; sago, tapioca, and rice are universal, while rubber, both raw and vulcanised, has infinite uses, from pavements to palates.

Moreover, many tropical products have been successfully adapted to actual growth in temperate climates, and, apart from the potato, include melons, beans, sweet potatoes, ginger, tobacco, rice *et cetera*, besides oils, nuts, gums, and fibres in great variety.

From the enormous resources of the tropics the mechanical ability and initiative of progressive races are daily adding new comforts and resources to civilisation, besides improving the product itself. Immediately above our shores the Dutch in Java have cultivated cinchona to such excellence that they have transplanted quinine production from the Andes to the East Indies; and in like manner rubber growing has been taken from the Amazon to the Orient, while Java produces a better palm oil than Africa does.

I select these examples because they occur in the great Indonesian chain with which our tropical possessions are continuous.

In Australia, beginning from the other end of the scale, we have queerly reversed the process of adaptation. The tenacity of our explorers and pioneers gave us a heritage stretching from the equator through more than 40 degrees of latitude (a heritage extended last month to the South Pole itself), and the conservatism we inherited no less from our European ancestors harnessed it to the task of growing English products in the English way for the English-speaking markets. Indeed, holding as an article of faith the idea that white men cannot live in the tropics, Australia, paradoxically, has not only successfully implanted her people for several generations in a tropical and subtropical land, but has coerced it into the semblance of the homelands from which we have come. We have taken a country that, climatically speaking, is everywhere utterly different from the British Isles and that, with the exception of the tiniest moiety of South Victoria, is everywhere closer to the equator than any part of Europe whatever, and in those areas that pre-eminently owe their allegiance to the tropics we have produced in increasing profusion the fruits and products of temperate and even cold lands.

Man once again has demonstrated, as Lefèbvre claims, that—

> Humanity escapes more and more from blind determinism, from the mechanical causality of his environment. Man is more and more the master of Nature and would be still more so did he utilise better the resources he has created, and had he a less vacillating idea of civilisation.

In that struggle for progress which, I repeat, is pre-eminently the establishment of a beneficial accord between man and his constantly changing environment, human will is the dominating factor, and nowhere perhaps is this more important than in the Australia of this and the next generation.

We claim exclusively a semi-tropical and tropical continent, originally free from endemic disease; we have the suzerainty in New Guinea of a native dependency that can be to Australia what the Dutch East Indies have been to Holland; we stand perhaps on the threshold of events as revolutionary as those that transferred the seat of world interest from the Mediterranean to the Atlantic, for events are every day more clearly demonstrating the increasing importance in world politics of the Pacific. The conquest of tropical disease has placed in our hands the key of our destiny, and we may well take stock of our responsibilities and our resources.

Lawrence Lowell said some years ago—

> It is hardly an exaggeration to summarise the history of four hundred years by saying that the leading idea of a conquering nation in relation to the conquered was, in 1600, to change their religion; in 1700, to change their trade; in 1800, to change their laws; and in 1900, to change their drainage. May we not say that on the prow of the conquering ship in those four centuries first stood the priest, then the merchant, then the lawyer, and finally the physician?

It is true, but there is a greater lesson: in that greatest of all the problems that confront Australia—the demonstration to the world that we are capable of developing successfuly the greatest remaining accessible tropical area, and of bringing the scattered tribes of Melanesia out of their wilderness of famine and disease into the security of settled government and productive life—we require the intimate co-operation of all four, though, truly, with the recognition of the fact that, in tropical lands, health is the foundation upon which every other developmental activity must rest.

In Australia we have a greater population, purely white, living in the tropics than any other country in the world can boast, and these white men and women of the second and third generations live there without any loss of mentality, physique, or fertility. It is the demonstration to the world (admittedly largely an unconscious experiment, successful owing to the absence of any teeming native population riddled with disease, but, nevertheless, an outstanding demonstration) that the conquest of climate is primarily, essentially, the conquest of disease.

That once achieved, we may say, as Shelley sings:—

> All things now are void of terror: Man has lost
> His desolating privilege, and stands
> An equal amongst equals. Happiness
> And science dawn, though late, upon the earth;
> Peace cheers the mind, health renovates the frame;
> Disease and pleasure cease to mingle here;
> Reason and passion cease to combat there;
> While Mind, unfettered, o'er the earth extends
> Its all-subduing energies, and wields
> The sceptre of a vast dominion there!

—*Shelley*, "Daemon of the World," lines 458-467.

AGRICULTURE ON THE AIR.

Radio Lectures on Rural Subjects.

Arrangements have been completed with the Australian Broadcasting Commission for the regular delivery of further radio lectures from Station 4QG, Brisbane, by officers of the Department of Agriculture and Stock.

On Tuesdays and Thursdays of each week, as from the 3rd April, 1934, a fifteen-minutes talk, commencing at 7.15 p.m., will be given on subjects of especial interest to farmers.

Following is the list of lectures for April, May, June, and July, 1934:—

SCHEDULE OF LECTURES.

BY OFFICERS OF THE DEPARTMENT OF AGRICULTURE AND STOCK, RADIO STATION 4QG, BRISBANE (AUSTRALIAN BROADCASTING COMMISSION).

Tuesday, 3rd April, 1934—"The Control of Tobacco Diseases in the Field." By L. F. Mandelson, B.Sc. Agr., Assistant Plant Pathologist.

Thursday, 5th April, 1934—"The Deficiency of Winter Feeding on Natural Pastures." By J. L. Hodge, Instructor in Sheep and Wool.

Tuesday, 10th April, 1934—"Cabbage Pests." By J. A. Weddell, Assistant Entomologist.

Thursday, 12th April, 1934—"Health of Dairy Herds." By J. C. J. Maunder, B.V.Sc., Veterinary Surgeon.

Tuesday, 17th April, 1934—"Lucerne Diseases." By R. B. Morwood, M.Sc., Assistant Plant Pathologist.

Thursday, 19th April, 1934—"Prevention and Treatment of Some Common Ailments of Dairy Cattle." By J. C. J. Maunder, B.V.Sc., Veterinary Surgeon.

Tuesday, 24th April, 1934—"Some Breeds of Poultry." By P. Rumball, Poultry Expert.

Thursday, 26th April, 1934—"Principles of Housing Poultry." By J. J. McLachlan, Poultry Inspector.

Tuesday, 1st May, 1934—"Squirter Disease of Bananas." By J. H. Simmonds, M.Sc., Plant Pathologist.

Thursday, 3rd May, 1934—"Working and Care of Separators." By F. J. Watson, Instructor in Dairying.

Tuesday, 8th May, 1934—"The Profitable Life of a Fowl." By P. Rumball, Poultry Expert.

Thursday, 10th May, 1934—"Replacement of Poultry Flocks." By J. J. McLachlan, Poultry Inspector.

Tuesday, 15th May, 1934—"Apiary Equipment." By Henry Hacker, Entomologist.

Thursday, 17th May, 1934—"Care of Cream on the Farm." By F. J. Watson, Instructor in Dairying.

Tuesday, 22nd May, 1934—"Problems of the Dairying Industry." By C. F. McGrath, Supervisor of Dairying.

Thursday, 24th May, 1934—"The Scientific Use of Stock Licks for Sheep." By J. L. Hodge, Instructor in Sheep and Wool.

Tuesday, 29th May, 1934—"Fat Lamb Raising as Combined with Agriculture." By J. Carew, Senior Instructor in Sheep and Wool.

Thursday, 31st May, 1934—"The Effect of Parasites in Sheep and Methods of Control." By J. Carew, Senior Instructor in Sheep and Wool.

Tuesday, 5th June, 1934—"Pineapple Wilt." By H. K. Lewcock, M.Sc., Assistant Plant Pathologist.

Thursday, 7th June, 1934—"The Frozen Pork Trade." By E. J. Shelton, Senior Instructor in Pig Raising.

Tuesday, 12th June, 1934—"Insect Pests of Ornamental Trees and Shrubs." By A. R. Brimblecombe, Assistant to Entomologist.

Thursday, 14th June, 1934—"All Fresh is Grass—A Great National Asset." By J. F. F. Reid, Editor of Publications.

Tuesday, 19th June, 1934—"Selection and Mating of Poultry." By P. Rumball, Poultry Expert.

Thursday, 21st June, 1934—"Rearing and Feeding Chickens." By J. J. McLachlan, Poultry Inspector.

Tuesday, 26th June, 1934—"Grain Pests." By Robert Veitch, B.Sc., F.E.S., Chief Entomologist.

Thursday, 28th June, 1934—"Grading Pork and Bacon Carcasses." By E. J. Shelton, Senior Instructor in Pig Raising.

Tuesday, 3rd July, 1934—"Results of Disease-resistance Trials with Cane Varieties." By A. F. Bell, Sugar Pathologist.

Thursday, 5th July, 1934—"Intensive Cane Cultivation and Costs of Production." By Dr. H. W. Kerr, Director, Bureau of Sugar Experiment Stations.

Tuesday, 10th July, 1934—"Preparing Pigs for Show." By L. A. Downey, Instructor in Pig Raising.

Thursday, 12th July, 1934—"The Principles and Practice of Pig Feeding." By L. A. Downey, Instructor in Pig Raising.

Tuesday, 17th July, 1934—"Plants Poisonous to Stock." By C. T. White, Government Botanist.

Thursday, 19th July, 1934—"Plants Poisonous to Stock." By C. T. White, Government Botanist.

Tuesday, 24th July, 1934—"A Ramble in Rural England and Its Lessons." By J. F. F. Reid, Editor of Publications.

Thursday, 26th July, 1934—"An Excursion to Scotland—Live Stock Studies." By J. F. F. Reid, Editor of Publications.

Tuesday, 31st July, 1934—"Queensland—A Fruitful Country." By J. F. F. Reid, Editor of Publications.

OUR TRADE WITH GREAT BRITIAN.

The annual report of the Australian Association of British Manufacturers makes interesting reading. It shows, for instance, that Great Britain's percentage of Australia's imports has increased from 38.4 per cent. in 1930-31 to 39.5 per cent. in 1931-32, and to 42.1 per cent. in 1932-33, which is larger than that of 1929-30. It states also that, in the Commonwealth, tariff reduction has coincided with a period of substantially increasing employment. The Ottawa Agreement is discussed, and the hope expressed that from now on programmes of inquiries arranged by the Board will consist largely of matters that are dealt with as the result of specific requests my United Kingdom interests, through the British Government. One of the most serious developments of the past year, it states, is the phenomenal growth in the intensity of Japanese competition with British goods in the Australian market, and the report urges that the provision that all imported china and earthenware must be indelibly marked to indicate the country of origin, which came into force on 1st September, 1933, should be extended to cover other goods in which British manufacturers are faced with intense foreign competition. In regard to certain piecegoods, words indicating origin are to appear, after 1st February, 1934, on the selvedge of the cloth. every two or three yards. The association has also urged that action should be taken by the Australian Government under the Industries Preservation Act and "dumping preference"duties be imposed on goods from countries with depreciated currencies. But the Government is faced with difficulties in view of Australia's highly favourable trade balance with Japan.

What should have been one of the principal tasks of the Ottawa Conference seems to have been unaccountably overlooked—the setting up of a central general committee to study and advise on the problems arising now that the Dominions and Colonies and the United Kingdom are being linked together, more or less, fiscally and economically. Recent experience raises the problems of South African Government subsidies to Italian shipping, the importations of manufactures from the Far East, and the question what can the Far East take in return, to say nothing of inter-Empire competition in Colonial markets. Mr. Bruce, the Australian High Commissioner in London, now suggests that such a body should be created to study these and other complicated problems. If misunderstanding is to be prevented and grievances assuaged, such a body is indispensable.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock, which have qualified for entry into the Advanced Register of the Herd Book of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Ayrshire Cattle Society, production charts for which were completed during the month of February, 1934 (273 days period unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORN.			
	MATURE COW (OVER 5 YEARS), STANDARD 350 LB.			
Empress 9th of Rosemount	C. O'Sullivan, Greenmount	12,854·25	523·824	Bright Star of Cosey Camp
Star of Alfavale	W. H Thompson, Nanango	13,632·25	516·323	Greyleigh of Greyleigh
Beauty of Headlands	J. A. Heading, Cloyna	11,905·013	500·649	Beauty's Lad of Hillview
Roan 8th of Oakvilla	H. Marquardt, Wondai	13,897·53	497·069	Victory of Greyleigh
Myra 4th of Kilbirnie	Macfarlane Bros., Radford	12,919·77	492·373	Redman of Burton
Daisy 9th of Oakvilla	H. Marquardt, Wondai	10,705·06	414·34	Victorious of Oakvilla
Coronation of Happy Valley	R. Radel, Biggenden	8,575·25	351·56	Guiding Star of Blacklands
	JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.			
Pigeon 16th of Upton	H. Marquardt, Wondai	12,300·22	440·954	Kinsman of Greyleigh
Carnation X. of Oakvale	S. H. Teese, Veresdale	10,005·45	382·510	Mallow of Oakvilla
	JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.			
Mountain Home Olive	M. C. Lester, Laidley Creek West	8,885·75	333·296	Headlight of Greyleigh
Flower Girl of Blacklands	A. Pickels, Wondai	7,140·55	309·391	Fussy's Monarch of Hillview
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Envy 8th of Blacklands	A. Pickels, Wondai	7,697·45	299·864	Fussy's Monarch of Hillview
	JERSEY.			
	MATURE (OVER 5 YEARS), STANDARD 350 LB.			
Shamrock Farm Jean	J. Hunter, Borallon	9,633·96	574·112	Shamrock Farm Palatine
Lindley's Creamery 4th	A. Bulow, Mulgeldie	10,941	556·095	Lindley Billy Hughes
Kelvinside Ideal's Noble's Idol	R. and J. Williams, Glencliff	8,141·1	486·598	Noble of Yaralla

	SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.			
Oxford Amy	E. Burton and Sons, Wanora	6,547·75	374·748	Trinity Ambassador
	JUNIOR, 3 YEARS (UNDER 3½ Years), STANDARD 270 LB.			
Glenview Flora	F. P. Fowler and Sons, Coalstoun Lakes	4,739·6	295·133	Glenview Emperor
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
Bee of Inverlaw (365 days)	R. J. Crawford, Inverlaw	7,775·15	422·236	Bruce of Inverlaw
Glenview Echo Belle	F. P. Fowler and Sons, Coalstoun Lakes	5,270	338·134	Carlyle Larkspur's 2nd Emperor
Trinity Golden Wattle	A. Bulow, Mulgeldie	5,657	289·138	Trinity Field Marshal
Glenview Miss Etterey	F. P. Fowler and Sons, Coalstoun Lakes	3,946·95	255·235	Trinity Glenview Governor
	AYRSHIRE.			
	MATURE (OVER 5½ YEARS), STANDARD 350 LB.			
C. F. Vixen	F. C. Maun, Yarranlea	10,454·8	396·638	Longland's Roland
	JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.			
Fairview Ode	R. M. Anderson, Southbrook	10,489·88	413·052	Longland's Bonnie Willie I.
	JUNIOR 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
Auchen Eden Rosebud	J. N. Scott, Camp Mountain	6,084·46	248·886	Benbecula Majestic

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PLATE 118.—A CHAMPION MIDDLE WHITE SOW.

Conformation, quality, pedigree, temperament, all important qualifications in selection of breeding stock, are emphasised in this modern representative of the Middle White breed.

Plate 119.

A picturesque farm homestead on the property of Messrs. P. C. Gorrie and Son, Esk, Brisbane Valley.

Photo. by courtesy Brisbane "Courier-Mail."]

PLATE 120.
Obi Obi Creek, Queensland.

Photo. by courtesy Brisbane "Courier-Mail."]

Answers to Correspondents.

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. Cyril T. White, F.L.S.

Western Grasses.

McN. (Charleville)—

1. *Brachiaria piligera.*—This grass is very common in Western and Northern Queensland. It is a native species, but so far as I have observed grows mostly on old cultivation lands, along railway embankments, &c., or, in fact, anywhere where the ground has been disturbed. It seems to prefer such situations to the ordinary pasture. It is quite a good fodder grass, but we have not heard a local name applied to it.
2. *Brachiaria Gilesii.*—This grass is fairly widely spread in Western Queensland, and, like the other species, rather favours country where the ground has been disturbed, but is not confined to such situations. We have had no experience with it as a fodder, but most of the *Brachiaria* are quite good fodder grasses, nutritious, and relished by stock.

   Brachiaria is one of the genera split off from Panicum.

A Beautiful Native Flowering Tree.

J.M.A. (Montville)—

The specimen is *Pithecolobium grandiflorum,* a native of Eastern Queensland, and a very beautiful native flowering tree. We have not heard a common name applied to it. The genus *Pithecolobium* is widely spread over the tropical regions of the world, and is abundantly represented in the forests of South America, where some of the species are known as Monkey's Earrings on account of the peculiar twist in the pod. The pod is almost as beautiful as the flower. It is yellow on the outside, becomes very twisted, splits open, is red on the inside, and has bright black seeds. These black seeds, showing up in contrast against the red background, are very effective.

Button Grass.

C.K. (Maryborough)—

The specimen is *Dactyloctenium ægyptium,* the coastal Button grass. This grass seems to be liked by stock, and is worth planting in seaside localities. It is of annual growth, however, and dies out on the approach of the colder weather. Usually it lasts till somewhere about the middle of March. It is very common in North Queensland, but is evidently on the spread southwards.

How Botanical Specimens Should be Sent.

Mr. W. WORTHINGTON, of Proserpine, writes:—

I am greatly interested in your description of grasses and plants in the "Queensland Agricultural Journal," and would like to send some to you to classify. Would you inform me how and what to send, do you require all the complete stool of grass or would the seed stalk do, also how to pack same. I am sure a lot of your readers would send on specimens if they had some instructions printed in the "Queensland Agricultural Journal."

Mr. WHITE'S reply:—

I would be very pleased to identify and report on any specimens of grasses and other plants you care to send me. Of grasses the whole stalk doubled up so as to fit comfortably in a piece of newspaper should be sent. It is as well to include in the folder several additional seed heads. Of weeds, trees, &c., a flower or seeding stalk a few inches long should be sent.

Specimens may be sent fresh, though there is always a big chance of their becoming mouldy in transit. The best way is to dry the specimens flat between several thicknesses of newspaper for several days before sending, changing the papers several times until the specimens are perfectly dry. When sending more than one specimen, each should be numbered and a duplicate retained, when names will be forwarded corresponding to the numbers.

Kangaroo Apple.

W.B. (Dalby)—

The plant is *Solanum aviculare,* commonly called Kangaroo Apple. It is a native plant that often comes up as a weed, particularly after a scrub burn. The berries are poisonous, and the young plants have also been regarded as poisonous to sheep. We would be very pleased to name and report any specimens you care to send from time to time. No charge is made for this service.

Guinea Grass.

T.T. (Birkdale)—

The grass is Guinea Grass, *Panicum maximum.* This is generally regarded as one of the best tropical grasses. For many years it did not seem to take on very well in Queensland, but judging from the number of specimens recently received, people seem to be taking a renewed interest in it. Stock are quite fond of it, and a small paddock of this grass for feeding down or cutting would be a decided asset. In Queensland it is often seen as a very common weed in orchards.

"Mistletoe Tree" and Other Poisonous Plants.

INQUIRER (Brisbane)—

The tree referred to as "Mistletoe Tree" is *Euphorbia tirucalli,* a native of Mexico, now cultivated as a succulent in most warm countries. The sap is very irritating, and if it gets into the eyes causes severe pain and temporary blindness. The branches, however, have to be broken, and if the plant is not overhanging paths no trouble should arise from it.

There are many plants commonly cultivated in gardens that are poisonous. One of the most commonly cultivated shrubs in Brisbane is the Oleander (*Nerium oleander*). The leaves of this plant are poisonous, and several cases of dairy cattle having been poisoned by trimming the bushes or by eating garden trimmings have come under our notice. A shrub cultivated fairly extensively is *Acokanthera,* more commonly known to gardeners as *Toxicophlœa.* The fruit of this is very poisonous. In the Botanic Gardens there is a tree, *Strychnos nux-vomica.* This tree fruits very heavily, but the seeds are the source of the very poisonous alkaloid strychnine. Some plants cause mechanical injury. The various Primulas, including *Primula malacoides,* give some people who handle them a severe skin rash, though other people are unaffected. One of the most popular plants is Bougainvillea, but the spines of this affect some people very badly if they happen to get torn or pricked by them. This list is not by any means exhaustive, and there are many plants cultivated in gardens which are dangerous, but surprisingly few accidents occur from them.

Spear Thistle—A Nutritious Legume.

"ANXIOUS READER" (Rockhampton)—

Your specimens have been determined as follows:—

(1) *Cnicus lanceolatus,* Spear Thistle. This is common in Queensland, New South Wales, and Victoria, and is the thistle generally spoken of here as the Common Scotch Thistle. The true heraldic thistle, however, of Scotland is a slightly different plant. Stock, particularly horses, eat the seed heads very freely in spite of the prickly nature of the plant. Its room, however, is preferable to its company. The plant seems to come in cycles, sometimes overrunning a district and then more or less dying out. During the past season it seems to have been particularly abundant everywhere.

(2) *Phaseolus lathyroides.* You speak of this plant as somewhat like a sweet-pea in growth. The specific name, *lathyroides,* refers to the similarity. It was introduced into Queensland as a fodder some years ago, and since then has spread fairly widely in the State. It has been spoken very highly of as a stock food, but here it seems to be very variable in this respect. In some places stock eat it quite readily, hardly touching it in others. I have not heard a local name applied to it. It is a leguminous plant and quite nutritious.

Canada Fleabane.

D.P.K. (Kilcoy)—

The plant you forwarded under the name of Rag Weed is Canada Fleabane, *Erigeron canadensis.* Two species of *Erigeron* are very common in Queensland—namely, *Erigeron linifolious,* a very tall, coarse-growing one, a common weed on scrub farms, particularly in banana plantations; the other is a greener plant, a common weed of cultivation, but extending more into the general pasture. We quite agree with you that this plant reduces very considerably the carrying capacity of the pasture. Nevertheless, we have had reports from farmers and pastoralists stating that they are readily eaten by stock. Probably the animals are making the best of a bad job.

A Beneficial Plant (*Grewia polygama*).

Inquirer (Melbourne)—

The specimen is *Grewia polygama*—the only knowledge we have about this plant is that it is very freely used in North Queensland as a remedy for diarrhœa and dysentery. The leaves are soaked in water overnight or maybe hot water is poured on them and the liquid allowed to become cold. It forms a somewhat mucilaginous liquid and is said to be very efficacious. We understand that in some parts of the North it is quite an article of trade, not only in North Queensland but in the Northern Territory and right over to the north-west of Western Australia.

Tree Tomato.

F.H. (Graceville)—

As far as can be told from the single leaf, the specimen is the Tree Tomato, *Cyphomandra betacea.* This plant belongs to the same family (Solanaceæ) as the tomato, but has a very different tasting fruit. They can be eaten either raw or stewed and have a peculiar flavour of their own not quite like anything else. Sometimes in excessively wet weather the plants lose their leaves, but often recover when the weather becomes drier. If you think your plant is dying and you wish to replace it, you can try taking off some of the young shoots at the top and putting them in as cuttings.

Leafy Panic Grass.

W.H. (Dagun, near Gympie)—

The grass is *Brachiaria foliosa,* the Leafy Panic Grass, a native grass and quite a good fodder for stock. It is sometimes found in the mixed native pasture, but on the whole rather prefers soil that has been broken or disturbed in some way, such as old cultivation paddocks, &c.

Carpet Grass—Crow Foot Grass.

L.R.B. (South Johnstone)—

(1) *Axanopus compressus,* the Broad-leaved Carpet Grass. This grass has gone under other names, such as *Paspalum compressum* and *Paspalum platycaule.* Two forms of it occur in Queensland, the narrow-leaved and the broad-leaved varieties respectively. We think the broad-leaved one is the better of the two, and is quite a suitable grass for tropical localities such as Innisfail. Of recent years this grass has come into Southern Queensland, and farmers are rather perturbed about its ingression into Paspalum pastures, as it has not the carrying capacity of the common Paspalum (*Paspalum dilitatum*). So far as our observations go, however, this latter species does not do well in really tropical localities such as Innisfail.

(2) *Eleusine indica,* Crow Foot Grass. This grass is very widely spread over the warmer regions of the world and is mostly found as a weed in cultivation, around back-yards, calf pens, &c., or in fact anywhere where the ground has been disturbed. It is not often found in the general pasture. Stock seem very fond of it, and, though we have had no losses from it in Queensland, it contains, like young Sorghum and some other plants, prussic-acid glucoside. Fed with caution, however, no trouble should be experienced from it.

SHEEP LAND FOR GRAZING SELECTION.

Oondooroo Resumption.

OONDOOROO resumption is situated on the Longreach-Winton Railway, in the Winton land agent's district, about ninety-five miles south-westerly from Hughenden, and embraces three portions with areas ranging from 24,000 acres to 26,000 acres. The portions will be opened for Grazing Homestead Selection at the Land Office, Winton, on Tuesday, 15th May.

The term of lease will be twenty-eight years, and the annual rental will be twopence half-penny per acre for the first seven years of the term.

The portions consist of good fattening and woolgrowing country, being principally open downs, with well-shaded channel country along the creeks and well-grassed with Mitchell, Flinders, and other grasses.

Water supplies consist of bores, equipped, with drains, tanks, and dams, and natural supplies in holes in creeks. Further supplies can be obtained by boring at a reasonable depth, and there are good sites for dams.

Other improvements consist of boundary and internal fencing, yards, and huts.

Each selection will require to be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years, and proof must be furnished of the financial standing and pastoral or land experience of the applicants.

Free lithographs and full particulars may be obtained from the Land Agents at Winton and Longreach, the Land Settlement Inquiry Office, Brisbane, and the Government Intelligence and Tourist Bureaux, Sydney and Melbourne.

POINTS IN GRAZING LUCERNE.

The chief points to be observed in grazing sheep on lucerne, if the best results are looked for, are:—

Paddocks should be subdivided, so that the size of the paddock is in correct relation to the size of the farm flock.

Sheep should never be allowed to feed on lucerne when it is raining, or both sheep and lucerne are liable to suffer.

Hungry sheep should never be turned on to lucerne, particularly if the growth is sappy.

If sheep are grazed for any time on lucerne alone, a dry pick is essential for the best results. Stock occasionally show symptoms of lucerne sickness when kept on it continuously.

General Notes.

In Memoriam.

PATRICK JOSEPH KENNEDY.

It is with great regret that we record the death on 24th February of Mr. P. J. Kennedy, an officer of the Marketing Branch of the Department of Agriculture and Stock. The late Mr. Kennedy was born at Ipswich, Queensland, in 1872, and was the second son of Mr. and Mrs. Daniel Kennedy, old and well-known residents of the Moreton district. He was educated at the Christian Brothers College, Gregory terrace, Brisbane, and subsequently entered the public service. He enlisted for active service with Queensland Mounted Infantry in the South African War. At the end of that campaign, he returned to Queensland and engaged in business activities on his own account. Soon after the constitution of the Council of Agriculture he joined the staff of that organisation and became closely associated with Mr. L. R. MacGregor, then Director of the Council of Agriculture and now Commonwealth Trade Commissioner in Canada. He afterwards received an appointment in the Department of Agriculture and Stock, which he retained until the time of his death.

In his younger days, the late Mr. Kennedy was a keen sportsman and excelled as a rifle shot, being a member of the Lowood and Brisbane Rifle Clubs. He won many trophies for his skill as a marksman, and in 1910 represented the State in Commonwealth competitions. He was laid to rest at Lutwyche Cemetery on 26th February in the presence of a large gathering, including many who had been associated with him in official and commercial life. The late Mr. Kennedy is survived by his widow (formerly Miss Maud Muller, of Warwick, Queensland), two daughters, and five sons, to whom the deepest sympathy is extended.

Staff Changes and Appointments.

Mr. W. D. C. McNeill, Inspector in Charge, Helidon and Crow's Nest Tick Cleansing Area, and Mr. D. Hardy, Inspector of Stock, have been appointed District Inspectors of Stock, Department of Agriculture and Stock.

Mr. E. A. Green, Inspector under the Diseases in Plants Acts at Wallangarra, has been appointed also an Inspector under the Apiaries Act.

Constables C. C. Francis (Mount Perry) and C. Zillmann (Bundaberg) have been appointed also Inspectors under the Slaughtering Act.

Constable H. P. Gerber, of Chillagoe, has been appointed an Inspector of Slaughter-houses at that centre.

The following persons have been appointed Honorary Rangers under and for the purposes of the Animals and Birds Acts as from the 10th March:—Mr. A. Marshall (manager, Malvern Downs Station, Capella), Messrs. M. A. Martin and B. Anderson (Bundaberg), Messrs. B. R. Beirne, H. A. Muller, and C. O. Sharp (Toowoomba), Mr. F. H. Barlow (City Engineer, Toowoomba), and Aldermen J. Robinson, J. Platz, and F. B. Common (City Council, Toowoomba).

The resignation of Mr. J. C. Wilson as an Agent under the Banana Industry Protection Act at Wamuran has been accepted as from the 10th March.

Open Season for Game.

The Minister for Agriculture and Stock, Mr. Frank W. Bulcock, in announcing the issue of an Order in Council providing for an alteration in the dates for the open season for duck and quail in Southern Queensland for a period of five months from the 14th April, pointed out that the protective period of seven months prescribed in the previous Order in Council extended from the 1st October in each year to the 30th April in the following year, inclusive.

Acting on information supplied from authoritative sources, it was decided that this period might operate somewhat earlier than usual, in view of the fact that ducks and quail were fairly plentiful, especially on the Darling Downs.

Mr. Bulcock emphasised the fact that, although an alteration had been made in the date for the opening of the season, there was no intention to reduce the period of seven months' annual protection, which would apply as hitherto, and would be strictly enforced.

Citrus Levy Regulation.

A Regulation has received Executive approval empowering the Committee of Direction of Fruit Marketing to make a levy on all citrus fruits marketed for the year ending 28th February, 1935.

The levy is at the same rate as that of last year, namely, 5s. per ton on fruit sold for factory purposes, 3s. 2d. per ton on fruit forwarded by rail for other than factory purposes, and one penny per case on fruit forwarded otherwise than by rail for other than factory purposes. The levy may be collected by agents or persons who hold to the credit of growers money on account of citrus sales, or, in some cases, by the Commissioner for Railways, and the method of collection shall be by means of levy stamps obtainable from the C.O.D., which shall be affixed to account sales or credit notes. In the case of citrus fruits sold privately, the grower shall furnish a return of such sales to the C.O.D., and pay the levy due. Carriers of citrus fruits shall furnish a monthly return to the C.O.D. of all fruit carried for market.

The sums raised by the levy shall be expended in the interests of the citrus industry.

Proposed Plywood and Veneer Board.

Following on the presentation to the Government of a petition by producers of plywood and veneer requesting that all plywood and veneer produced in that portion of Queensland south of the 23rd degree of south latitude be declared commodities under "The Primary Producers' Organisation and Marketing Acts, 1926 to 1932," and that a Board be constituted in relation thereto, a notice of intention to make an Order in Council to give effect to the above request has been issued.

A petition for a poll to decide whether this order should be made must be signed by 25 per cent. of the growers of plywood and veneer, and must be lodged by the 23rd April next.

The proposed Board shall be a marketing board and shall consist of ten elected representatives of the growers and the Director of Marketing and an Officer of the Forestry Department. The Board shall be constituted for one year, and growers of the commodities shall be those persons who own plywood and veneer plant, and have produced plywood and veneer for sale. Upon making the order, the commodities shall be vested in the Board as the owners thereof.

The Minister is empowered to appoint an Officer of the Forestry Department to be an additional member of the Board.

Provision will be made in the order that the Plywood and Veneer Board shall have authority to acquire and allocate raw material (including timber) required by producers, and shall receive and allocate to the producers, on a quota basis, as decided by the Board, all orders for the supply of plywood and veneer, and shall control the marketing thereof.

The Board shall also control the appointment and registration of agents in Queensland, the Commonwealth, and in other countries, and shall determine the remuneration of such agents.

Nominations will be received at the Department of Agriculture and Stock, until 23rd April next, for the election of ten growers' representatives on the proposed Plywood and Veneer Board. Each nomination is to be signed by at least five growers of plywood and veneer.

Sugar Cane Prices Boards.

An Order in Council has been issued under the Regulation of Sugar Cane Prices Acts removing all members of Local Sugar Cane Prices Boards who were appointed for the currency of the 1933 crushing season.

The annual elections have now been completed. and the Governor in Council has to-day appointed the Millowners' and Canegrowers' Representatives on the various Local Boards, together with the Chairman of each Board, for the forthcoming season.

Protection of Wage Levels.

A league has been formed in London to urge upon the Government that each section of the Empire must recognise that it is its duty to protect its own wage level, to allow free competition on that level, but to demand an import duty equivalent to any difference between domestic and externally lower costs.

Protection of Native Flora.

For the purpose of effectively preventing the wanton destruction and removal of protected native plants throughout the State, the Department of Agriculture and Stock has sought the co-operation of the Main Roads Commission, and fifty-three officers of the Commission stationed throughout Queensland have been appointed Honorary Rangers under the Native Plants Protection Act.

Strawberry Culture.

March and April are the main planting months for strawberries in Queensland. A pamphlet containing instructions in strawberry culture is now available for distribution on application to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Canary Seed Board.

Nominations will be received by the Returning Officer, Department of Agriculture and Stock, Brisbane, until the 26th April, 1934, for election as Growers' Representatives on the Canary Seed Board for the period as from the 1st June, 1934, to the 31st May, 1935. Two such representatives are to be elected by canary seed growers, and each nomination is to be signed by at least five persons who have grown or have growing canary seed for sale between the 1st June, 1932, and the 31st May, 1934.

De-grading of Bananas.

The Minister for Agriculture and Stock (Hon. F. W. Bulcock, M.L.A.) stated recently that the Chairman of the Banana Industry Protection Board (Mr. H. Barnes) had reported to him that the Board was making inquiries into the reason for the big increase in the number of cases of bananas being de-graded in Melbourne.

The grades in both Victoria and New South Wales are similar to those in Queensland, and the Inspectors in all three States take the same measurements, i.e., from the outside of the curve from the end of the stalk to the butt at the flower end. There has always been a certain amount of marking down in Sydney and Melbourne, and it has been ascertained this is almost invariably due to the faulty or careless grading and packing by growers. As, however, defaulting growers are periodically advised of their errors, it is difficult to understand now why there should be such a big increase in the number of cases of fruit de-graded, instead of a gradual decrease.

Arrowroot Board.

The only nominations received at the Department of Agriculture and Stock, in connection with the election of five growers' representatives on the Arrowroot Board, were from the present members, namely:—

Carl Brumm (Woongoolba).

James Francis Cassidy (Woongoolba).

Alexander Rose (Norwell).

Robert Stewart (Ormeau).

George Rawlinson Walker (Upper Coomera).

These persons will be appointed for a further term of three years.

No Open Season for Opossums.

The Minister for Agriculture and Stock (Mr. Frank W. Bulcock) has called attention to certain unauthorised reports which have been circulated and which would indicate that a decision has been arrived at to declare an open season for opossums during the present year. Mr. Bulcock deprecated any action which might mislead trappers and others interested, and again emphasised the fact that no decision had been made on the matter by the Government.

It must be obvious to all persons interested in the opossum fur trade that oversea market conditions are a primary factor in any decision to open the season and for that reason close touch is kept with the London markets. It is noted that in the September and January sales there was a strong demand for skins of good quality, but those of inferior class were practically unsaleable. In any decision which will have a bearing on the opening of the season, the question of supply and demand must, in the interests of all concerned, and especially the trappers, be carefully studied as there would be no justification to decide in favour of an open season if supplies of suitable skins were not procurable or prices were offering which would not give the trapper at least a reasonable return for his labour and financial outlay.

Mr. Bulcock also drew attention to reports of illicit trapping and warned those who committed breaches of the law by trapping during the period of protection that every effort would be made to cope with these irregularities, and trappers in their own interests are advised that it would be unwise for them to take, what they might consider, a "sporting" risk in attempting to evade the provisions of protective legislation.

Citrus Crop Prospects.

The Minister for Agriculture and Stock (Mr. Frank W. Bulcock) stated recently that reports submitted to him by the Director of Fruit Culture (Mr. H. Barnes) on the prospects of the citrus crop in the various districts showed that the crop for the coming season promised to be an exceptionally good one. The previous forecast, earlier in the season, of a 50 per cent. increase would be fully realised in some districts. In the Gayndah district the crop was well forward and promised to be of good quality and size. The summer crop of lemons was now being marketed and satisfactory prices were being realised. In this district the industry was advancing on sound commercial lines, and growers were making negotiations for the establishment of a Co-operative Packing House, which would add to the good name the district had already built up as a producer of good-quality citrus fruits.

On the North Coast there was every promise of a big crop also. Mandarins were not in heavy bearing, as a severe drop was experienced when the fruit was setting, but nevertheless growers were looking forward to a good harvest. Although a number of new plantings had been made on the North Coast, the total acreage there was not increasing owing to the number of orchards which were yearly going out of production, due to unsuitable conditions.

The Tambourine Mountain district expected to market a record crop this year of excellent fruit. This district, during recent years, had increased its acreage very considerably, and, provided weather conditions were favourable during the blossoming period each year, could be looked to to produce in a few years a considerable percentage of the State's annual citrus yield.

Honey Board.

A vote on the question of the continuance of the Honey Board for a further term of five years was conducted at the Department of Agriculture and Stock to-day with the following results:—

	Votes.
For the Continuance of the Honey Pool	100
Against the Continuance of the Honey Pool	70

The election of members was also taken, and resulted as follows:—

	Votes.
Charles William Edwards (Greenbank, via Kingston) ..	228
Robert Victor Woodrow (Woodford)	196
Henry Edgar Fagg (South Killarney)	195
Owen Norman Tanner (Samford)	184
Roy John Bestmann (Caboolture)	100
Alfred Gambling (Raceview, Ipswich)	97

The first four-mentioned persons will therefore be elected for a term of two years as from the 9th March next.

The retiring members were Messrs. Edwards, Fagg, and Tanner. Mr. J. Schutt did not seek re-election.

Rural Topics.

Diseases of the Udder of Dairy Cows.

Since the udder secretes the milk which is the staple product of the dairy farm, its health is of prime importance to the farmer. Unfortunately it is liable to be affected, with a number of diseases, which may not only considerably lessen the milk production (sometimes permanently), but also may have serious effects on the general health of the animal. The more important diseases affecting the udder are infectious, but by careful attention to sanitary management they may be controlled to a large extent.

Inasmuch as milk forms a very important article of human diet, particularly for children, a considerable responsibility is thrown on the dairyman to supply only a pure, wholesome, disease-free product.

Structure of the Udder.—The udder or mammary glands of the cow consist of two halves, separated along the middle line. Each of these halves is divided into two quarters. The halves are separated by a well-marked partition, but although the two quarters of each side do not communicate with each other, there is no visible division between them. The udder is covered with a soft pliant skin, upon which are fine soft hairs. Hair, however, is not usually present on the teats. The gland tissue itself is arranged in a great number of lobes which communicate with tiny tubes or ducts. These ducts run into larger vessels, and by these the milk secreted in the gland is conducted to a cavity known as the milk cistern, above the base of each teat. Each quarter has a teat through which the milk is drawn during milking. The teats are cylindrical in shape, soft, and elastic to the feel. Each contains a single passage or duct which opens above to the milk cistern and below to the tip of the teat.

The size and texture of the udder varies in different animals and different breeds. An udder which shrinks up after milking (milks out like a glove) is preferable to a large fleshy udder which does not shrink much in size when empty, and which denotes, usually, that the cow is not a great milk producer.

On handling the empty healthy udder the gland should be of the same consistence throughout. There will be a great variation in the actual "feel," depending upon the texture of the udder in the animal under examination, but the texture should be similar right through the organ; no lumps or thickenings should be detected.

Evidence of Udder Disease.—Different diseases affect the udder in different ways. Some affections may attack the skin mainly, others the gland tissue; some diseases make an acute attack on the gland and the symptoms appear suddenly, others are slow-moving in their effect, the changes taking place being gradual. Some of the common changes which occur are:—

(1) The milk becomes watery or thickened, contains minute or larger clots, contains blood or becomes discoloured. It may have an unpleasant smell.
(2) Milk production may be more or less rapidly decreased, or cease altogether.
(3) The skin may show the presence of reddened, sore areas, scab formation, or small pustules.
(4) The udder may be hot, tense to the feel, and painful to handle.
(5) Hard lumps may form in the udder.
(6) The whole of the quarter may become uniformly hard.
(7) The quarter may "waste away" and become useless.
(8) Swellings may occur in front of or behind the udder.
(9) One quarter or more of the udder may die and slough off, leaving a gaping raw wound.
(10) In addition to any of the above, the animal may show signs of general disturbance of health, refusal of food, panting, shivering, and so on.

From the above it will be seen that, although in many cases the changes in the milk or the udder are obvious and cannot be mistaken, in others the changes are gradual and not likely to be detected unless sought for.—A. and P. Notes, New South Wales Department of Agriculture and Stock.

High Speed Porkers.

A leading firm of stock food manufacturers in the British Isles, in emphasising the value of their commercial pig foods, speaks of them as producing high speed porkers. They claim prime porkers reach 120 lb. live weight in twenty weeks, and high-grade baconers 200 lb. live weight in twenty-seven weeks or less. They emphasise, however, that such high speed results can only be maintained when the best materials are used in the most skilful manner and with stock that are well bred and of the best commercial type. The day of the mongrel pig has gone for ever. The only pigs that are profitable in these days are those that are well bred, well fed, and carefully managed. This emphasises the slogan—"Better Pigs for Every Farmer."

Pigs—Grain and Milk.

An overseas contemporary, in discussing the success of the Danish farmer, indicates that Denmark established her pig industry, not on co-operation as so many seem to think, but on her ability to change her agricultural policy to meet new conditions.

When the increased quantities of cheap grain began to arrive from the American and Canadian prairies, Danish farmers, as grain producers, were unable to meet the severe competition. In order to remedy the difficult situation they turned to technical improvement. The surplus export of grain was replaced by a rapidly growing export of animal products, such as butter, bacon, and eggs. The prosperity of Danish agriculture during the past fifty years was based on the Danish dairy industry, bacon production being subsidiary in that it afforded an opportunity of making full use of dairy by-products.

Cheap feeding stuffs would seem to be essential to the successful development of pig production. To be successful the pig must be fed on farm-grown grain, milk and other products, and of these foods, grain, milk, and root crops hold pride of place.—E. J. SHELTON, Senior Instructor in Pig Raising.

Watering of Cows.

Experimental investigations have proved very definitely the value of giving cows free access to water at all times. The U.S.A. Bureau of Dairy Industry investigated this matter in 1931. The tests were carried out in both warm and cold weather, and with high and low producing cows.

The effect on consumption of watering twice a day was compared with results obtained when the cows had free access to water. The cows drank 1.5 per cent. more water when watered twice a day than when allowed to drink at will, and 13.3 per cent. more than when watered only once a day. They produced most, however, when given free access to water, averaging 2.8 per cent. more milk and 2.1 per cent. more butter-fat than when watered only twice a day. Twice-a-day watering as compared with the practice of giving water only once a day gave, on the average, an increase of 1 per cent. more milk and 1.4 per cent. more butter-fat. It was also found that the increase in milk production as a result of more frequent watering was more marked in the case of the good producers than in that of the low producers.

Benefits of Fallowing.

Twelve district societies organised competitions in the western wheat zone of New South Wales last season, and, notwithstanding the unfavourable conditions, the average of the yields of all competing crops was 29¾ bushels per acre—an excellent performance, comments the Chief Instructor of Agriculture, New South Wales, in his report as judge:—

"In such an adverse season as that experienced in the southern and western portions of this division, the production of yields of 24 bushels per acre may be regarded as an achievement, which was made possible by the practice of fallowing. This result should be sufficient to demonstrate that fallowing is the best insurance against drought, and should persuade wheatgrowers that it is essential to successful farming in these areas and encourage them to make it a general practice.

"In every instance the initial cultivation of the fallow was completed by August, and it may be of some significance that the crop produced on the fallow which was ploughed on the latest date exhibited the most evidence of distress in the final stages. The earlier the fallow is ploughed the longer is the land in a receptive condition to absorb any rains that may fall, and not only is there an increase in the amount of moisture conserved, but the other benefits of fallowing are increased, such as control of weeds and disease, the production of nitrates, and the preparation of a good seed-bed."

Protein in the Ration—For Milk Production.

In his report on a competition recently conducted by Camden Haven branch of the Agricultural Bureau of New South Wales, the departmental dairy instructor who acted as judge emphasised the value of protein in the feeding of cows for production. The protein or nitrogenous portion of any fodder mixture, it was stated, was the most expensive one to provide, but it had been very truly said that the secret of milk production lay in the provision of a plentiful supply of protein. Common fodders rich in protein were lucerne, cowpeas, and vetches, and among the concentrated fodders, linseed meal.

"Balancing" a ration meant that the foods were to be mixed in such a way that all the constituents thereof could be most economically made use of by the cow. For instance, saccaline contained a large proportion of carbohydrates—sugar. If fed on a ration of saccaline only, the cow would use only such proportion of the carbohydrates as she required, and the remainder was wasted. To "balance" the carbohydrates, a fodder containing more protein should be mixed with the saccaline, and the quantity of the latter reduced. A suitable fodder would be lucerne hay. Substitutes, however, could be cowpeas, vetches, red and berseem clovers. A crop which was very high in protein and which had not been tried in New South Wales to any extent was the soy bean, a crop which was grown very extensively in the United States.

The cow's natural fodder, and one which naturally provided a balanced ration, was a mixture of grasses and clovers in bloom, and if this could be provided for her all the year round, it would be easily the most economical method of feeding. A start in the right direction was the provision on most of the farms of areas of winter grasses and clovers. If continued and extended into a number of small paddocks on each farm these would be of incalculable benefit in time to come, when it might be possible for paspalum and clover pastures to provide grazing in the summer, with rye and clover pastures for the winter, reserves in case of necessity being provided by the pit silo.

A Point in Pig-Feeding.

If the value of all the food wasted annually in pig-feeding could be accurately estimated, observes a South African paper, it would certainly amount to a very considerable sum. That money would be much better in somebody's pocket than on the muck-heap.

A certain amount of wasted food is inevitable, but a great deal of the waste that occurs might be prevented by a little foresight. Unsuitable troughs are, perhaps, the first and most frequent cause of wasted food. When pigs are fed with slop in troughs which have no rim, a certain amount of food is bound to be pushed overboard and lost.

Food is also wasted when the trough accommodation is not sufficient for the number of pigs, and again when there are no divisions, so that the pigs jostle one another or can run their noses along the bottom of the trough, as they often will. This habit is encouraged when food is mixed too thinly, for this induces the pigs to push to the bottom for the solid matter to be found there. That results in a good deal of the liquid being pushed over and any meal suspended in it is lost.

Cream Quality Affects Butter Quality.

The low prices at present being received by suppliers of cream may prove a temptation to some to be satisfied with a little less than the best possible in the way of quality of the product when it leaves the farm, observes the "Agricultural Gazette" of New South Wales. Producers should remember, however, that upon the quality of the cream supplied depends the quality of the butter that that factory can produce, and that any falling off in butter quality would have a serious effect upon prices, and upon the dairying industry.

Not only does a decrease in cream quality affect the reputation of the output of a factory, but it actually penalises the producers of really high quality choicest cream, by injuring the quality of the butter made from that cream when blended with a cream of lower quality. The larger the proportion of "bare choicest" cream that is used at a factory, the greater the danger of a falling off in the quality of the butter produced.

Though modern methods of manufacture may do a lot towards eliminating undesirable features in cream, the factory should only be called upon to deal with those faults which it is impossible for the producer to avoid.

Lucerne, a Hardy Crop.

The following interesting evidence of the persistency of lucerne under unfavourable conditions appears in a recent issue of the "Agricultural Gazette" of New South Wales:—

"By way of experiment the Department sowed an area of lucerne in 1925 on the property of Messrs. D. and J. Gagie, West Wyalong. The germination was poor, and although the stand was given no after-treatment by way of renovation or top-dressing, and has had to weather abnormally dry and wet seasons, and, furthermore, has at times been subjected to very harsh treatment by being heavily grazed when droughty conditions made other feed very scarce, it has proved to the Department's satisfaction that a lucerne stand will provide good grazing in the Wyalong district for as long as seven years. Given reasonable care and attention, the stand should remain in excellent order, and free of weeds for from eight to ten years.

The stand on Messrs. Gagie's farm was continuously stocked with horses throughout its whole life, except for the six months, May to October, 1926. The fact that any of the plants at all survived this treatment during the long dry spells is proof of the persistency of lucerne under adverse condition of climate and management. Not only did this stand have to survive droughty conditions, but during the first six months of 1931, when 21 inches of rain were recorded, it was under water no less than four times.

"The lucerne on Messrs. Gagie's farm was sown in September, 1925, at the rate of 7 to 8 lb. per acre. Later experience has shown that 4 to 5 lb. per acre sown in the autumn will result in a better stand."

Care of the Milking Herd.

Absolute cleanliness and care at all points are necessary for the ensurance of quality in milk and cream. Following are some important precautions in the care of the milking herd:—

Keep milkers away from weeds. Ordinary food flavours from such fodders as lucerne, silage, &c., can be removed by aeration and cooling of milk and cream on the farm, and pasteurisation at the factory; but strong food flavours or taints, such as from carrot weed, cannot be got rid of.

Clean, fresh, running water is best, and next to it comes good spring or well water pumped into troughs. Water contained in dams, marshes, or stagnant pools is bad, and is swarming with harmful germ life. Milking cows should be prevented from wading into such places, otherwise they bring the contamination into the milking-yard by the mud which clings to their skins. Those in this state should be brushed and wiped, and have their udders washed before milking. The same applies when they have to wade up to their bellies through muddy yards. If this is not done, the dust from the dried mud falls into the milk bucket, and the dirt on the udder and teats oozes through the milker's fingers and mixes with the milk, which then produces fermented and badly flavoured cream.

Milk should be well strained. A filter cloth fitted on top of the gauze of the strainer will greatly help in improving the milk. These cloths should be destroyed or thoroughly boiled for twenty minutes before being used again.

Give the cows high, clean, dry ground to camp on. The infections caught in low-lying, swampy ground and stagnant water cause most unclean flavours and smells in cream and butter, and they are also often responsible for fermented cream and sour milk.

In wet weather scrape the cows with an iron hoop before milking to prevent drips from falling into the bucket. Milk from sick or diseased cows should not be used for human consumption, or for making butter or cheese. The milk from injured teats should be thrown away.

Tribute to the Butter Board.

At the recent Rockhampton Ward Conference of the Queensland Producers' Association, it was moved by Mr. Harding, seconded by Mr. Legh: "That this conference of farmers notes with relief the enactment of the Commonwealth butter marketing legislation, which we consider to be the greatest achievement to date towards the objective of securing for dairymen a return for their services equivalent to that received by other sections of the community for their services; and we record our appreciation of and thanks for the work of our dairying leaders, particularly Mr. Chris. Sheehy (secretary of the Council of Agriculture) and Queensland Butter Board, who have been responsible for the success."

Points for the Inexperienced Poultry Raiser.

The Minister for Agriculture and Stock, Mr. Frank W. Bulcock, stated recently that he had had brought under his notice several cases of buyers of poultry having been duped, and for the benefit of the inexperienced poultry raiser, he had made the following statement:—

"On commercial poultry farms, cockerel chickens that are not required are selected at an early age, usually from four to six weeks, and sold in the auction market. The reason for the sale of the cockerel chickens at this age is due to the fact that most breeders are of the opinion that it would not be profitable to keep them any longer. It is becoming a practice of some dealers to buy these unwanted cockerels and advertise them for sale as purebred White Leghorn chickens, age four to eight weeks. This class of advertisement is misleading. Although the birds offered for sale are chickens, they are cockerel chickens. Inexperienced persons are induced to purchase as the result of this type of advertisement, thinking that they will obtain an equal number of females and males, and as the chickens are partially grown, consider that an added advantage."

Mr. Bulcock further mentioned that this class of chicken came direct from the brooder to the market, that they had not been weaned from the brooder and consequently were at a difficult stage to handle; moreover, that birds of this age would not travel as well as day-old chickens.

There was another type of deception practised on unsuspecting buyers, and that was the sale of culled and discarded hens. It was a common and necessary practice for poultry farmers to cull their flocks, due to the fact that birds become unprofitable as they age. These culls are sold in the market for table purposes, and it is not uncommon for these birds to be bought by dealers to meet the demand resulting from an advertisement. One dealer appeared to operate under more than one name, and had been known to state to a prospective client that he was selling the stock from his brother's farm in a certain locality. Upon investigation, no brother's farm could be traced, but it was ascertained that he had been a constant buyer of culled hens from one auction room.

The Minister considers that this class of business is distinctly undesirable, and warns prospective purchasers against buying so-called chickens on account of their sex and the unwanted hens of commercial poultry farms.

Grade Your Seed Wheat.

It is very important in the sowing of wheat that only graded seed be used. Grading not only removes wild oats and other foreign seeds, but also ensures uniformity. If the size of the seed is uneven the sowing will be uneven, inasmuch as the grain will not run evenly through the cups of the drill.

It must not be imagined that because small grains are sown, weak or poor plants will necessarily result. As a matter of fact, if the smallness of the grain is due to adverse weather conditions during growth, no harm is done—indeed, the crop may be a vigorous one. But if the smallness of the grain is due to the parent plant having been weak or diseased, it is obvious that a good strain cannot result. In order to be on the safe side, therefore, farmers should thoroughly grade their seed before sowing.

Various types of graders are on the market, but it will generally be found that the type equipped with the cylinder and perforated screens is the most efficient, and for all practical purposes the single-cylinder machine is the most convenient. For small quantities of up to, say, 250 or 300 bushels, a hand machine will answer the purpose admirably, but for larger quantities of wheat it is advisable to drive the grader with a small power engine.

Unless experimenting, the wheat-grower should sow only varieties which have proved the best yielders in his district.

Some varieties fulfil a dual purpose, and can be cut for hay or harvested for grain. On the other hand, farmers growing wheat for the chaff market must exercise particular care in choosing suitable hay varieties. Further, in growing for grain the difference between the yields of a suitable and unsuitable variety may be as much as a third of the yield.

In general, the best yielders are those that are able to make use of the full growing period in their respective districts—that is, those that can be sown seasonably.—A. and P. Notes, N.S.W. Department of Agriculture.

Feeding of Pigs.

Much better results would be obtained in pig-farming if closer attention were given to the important question of feeding. The many points which make for successful results must be carefully observed from the time that the pig is born to the time that it is marketed. Unfortunately many pig farmers appear to be under the impression that the pig will thrive under whatever conditions it may be fed and on food which may be actually unwholesome.

The foods available (and there is a considerable choice of pig foods in New South Wales) must be so used that the animal is supplied with adequate material for growth and early maturity. A properly balanced ration is necessary, by which is meant that the nutritive constituents are associated in such proportion as to produce the results sought in feeding with little or no waste. The feeds available on most farms are quite adequate, but the way in which the animals are fed is the cause of many losses of young pigs. Pigs require to be fed from clean vessels and from clean troughs, free from crevices. The trough should preferably be of concrete built into a concrete floor.

The pig is well adapted for the disposal of many waste foods of the household, farm, orchard, and dairy, but unless these foods are in a sound and wholesome condition serious troubles may be caused by their use, and the quality and market value of the carcase may suffer. Of all farm animals the pig responds most readily to generous feeding; the stomach is only small, but the intestines are of great length, indicating great digestive powers, and for these reasons the pig must be fed frequently and at regular intervals.

The value of grazing and pasture crops is becoming more recognised, and when their use is combined with the feeding of maize or other grains good results are obtained. Green feed regulates and tones up the digestive and circulatory systems and keeps the animal in a healthy condition. It has to be recognised, however, that green feed will not entirely replace grain. Skim milk and butter-milk are of great value as pig food, not only when fed by themselves, but more particularly when combined with maize, as they greatly increase the digestibility of the latter and effect a saving of grain. Favourable climatic conditions, plenty of good, clean water, good grazing land, and association with dairying on a small scale are factors in the cheap production of pork.

It is necessary, if the best price is to be obtained, that the pigs should be of the correct type, well fed and topped off before being sent to the market, and the growing conditions should be so arranged that they develop and arrive at the desired weights in a specified time. A system of grading should always be in operation on the pig farm, each grade being kept in its own yard or small paddock. Unless such a system is followed the large pigs do not give the smaller ones a chance, the result being that the latter take longer to get into market condition, with consequent loss to the producer.—A. and P. Notes, N.S.W. Department of Agriculture.

Soil Erosion—Value of Contour Drains.

"Although hill land on the far South Coast (N.S.W.) was not flooded by the recent deluge, in many instances it suffered greater damage than did alluvial land—and damage that, unfortunately, is irreparable," writes an officer of the Department of Agriculture in the current "Agricultural Gazette" of New South Wales. "On nearly every farm, paddocks are to be seen that have suffered 'gullying' and 'sheet erosion,' one being as bad as the other, although the damage resulting from the latter is not nearly as evident as that from the former.

"A striking example of the value of contour furrowing for the prevention of this erosion is to be seen on the farm of Mr. C. N. Squire, at Springvale. On this farm, as hilly as any other in the district, the damage by washing from the rains was practically nil, the reason being that Mr. Squire having realised the value of contour furrowing his country, had carried it out on all his cultivations, and he has now reaped the reward. With all the rain, these single furrows, placed about ½ to 1 chain apart depending on the slope of the land, carried all the water across the paddocks, and did not allow it to go its own course and cause scouring.

"The farmers of the Bega district should make an effort to visit this farm and see for themselves how this recently-introduced method of preventing soil erosion stood up to this severe test. Mr. Squire is every ready to explain the whole operation, from the construction of the home-made level to the completion of the single furrows that do the job. If contour furrowing will stand up to 13 inches of continuous rain, it will stand up to any weather likely to be experienced in this district."

Holding Power of Fruit Case Nails.

One of the problems which confront the users of softwood fruit cases is the tendency of the nails to withdraw from the wood if the case is subjected to rough handling in transit to market. To overcome this rusted nails are often used, while there are on the market special nails claimed to have holding power, such as barbed or jagged nails, twisted or spiral nails, cement coated and sand rumbled nails, and these are used to a considerable extent.

In order to determine the relative efficiencies of the various types of nails available, the Division of Forest Products of the Commonwealth Council for Scientific and Industrial Research recently carried out a comprehensive series of tests. Samples were obtained from the principal nail manufacturers of the Commonwealth, the size of the nail being standardised at 2¼ inches by 12 gauge; and Western Hemlock, by far the most commonly used timber for softwood containers in Australia, was used for the test.

The results (published by Ian Langlands in Technical Paper XI. of the Division) showed that the rusted nail had the highest static (gradually and steadily applied load) holding power, while twisted nails had the highest impact (load applied suddenly) holding power.

Combined composite figures (a straight average of the static and impact figures), considered to be the best expression of the all-round efficiency of the various types of nails, were also calculated, and these showed the twisted wire nail made from square wire to be superior to all others, next in order being the rusted nail and the twisted nails made from grooved wire. With the exception of cement-coated twisted nails, and a certain type of barbed and cement-coated barbed nail, the other types showed no significant improvement over the plain nail.

Lucerne for Grazing.

Some years ago the idea existed that lucerne would only grow satisfactorily on deep, rich, alluvial flats, but to-day it is considered to be one of our best and hardiest pasture plants for cold, as well as dry localities. The advantages of lucerne as a pasture are:—

1. It gives good grazing most of the year and produces rapid growing and very fattening feed.

2. It provides fresh green feed at most periods.

3. It can be stocked heavily with the knowledge that with a spell of a week or two, fresh green feed will again be available.

4. It provides excellent pasture on which to wean lambs or lamb down ewes.

5. Paddocks of lucerne can be kept free of "seedy" grasses.

Not only does lucerne provide succulent feed during most seasons in average years, but, once established, it will supply good picking in droughty periods, responding more rapidly than most pasture plants to even light falls of rain. Its value, either when sown alone for grazing purposes or in a pasture mixture, is rapidly becoming recognised, and it is safe to predict that larger areas will be sown each succeeding year.

Where conditions are favourable, early autumn sowing is recommended, at the rate of 2 lb. to 4 lb. per acre if sown alone, and 1 lb. to 2 lb. if sown as part of a pasture mixture.

Lucerne should not be heavily stocked the first season of its growth, as the plants are not then sufficiently strong to withstand the inevitable trampling. Again, it will not stand continual grazing at any time; and the method should be to put sufficient stock on to eat it down quickly, and then to move them off before the young plants have commenced to shoot. The paddock should be subdivided into small lots for grazing, so that the stock can be moved from one to the other in quick succession. Temporary fences could be erected and moved as required. Rapid feeding off prevents injury to the plants and reduces loss and excessive fouling of the feed.

Top-dressing with 1 to 1½ cwt. of superphosphate per acre should be carried out at least every second year. Apply the fertiliser in August, working it in with a spring-tooth or rigid tine cultivator.—A. and P. Notes, N.S.W. Department of Agriculture.

Clean Paddocks—How to Deal with Weeds.

The need for the freedom of paddocks from weeds of all kinds and the value of bare fallowing for the improvement of crops have again been emphasised by the Director of Agriculture (Mr. A. E. Gibson).

Mr. Gibson states that agriculture in Queensland has arrived at a stage where, in very many instances, more up-to-date and scientific methods must be applied. The pioneers who cultivated virgin areas of land received as their recompense crops that were both of good quality and heavy in yield. With the changed conditions, and because also of the low prices given for commodities, areas which in the earlier days gave comparatively good returns to the growers are now failing to give yields commensurate with those of the past, and, often, by no means satisfactory.

In addition to that many of the areas are weed infested, and Mr. Gibson says that the farmer who expects to get a return at all proportionate to the amount of work and capital involved must now give his attention urgently to the question whether his methods should not be amended and improved.

In the opinion of the Director, the first consideration is, perhaps, the cleanliness of the paddocks—that is, their freedom from weeds of all kinds. These can be eradicated only by cultivation; sometimes, by the use of grazing animals, and it is advocated that where it is possible to turn weeds into money by this means, that should be done. In this way the weeds are not only checked, but a valuable fertilizing influence is obtained from the grazing of the cattle.

Bare fallowing, Mr. Gibson also explains, is one of the greatest aids to weed eradication, and although farmers complain that they cannot afford to have paddocks lying idle through a full season, when those paddocks are cultivated at, or before, the beginning of the rainy season, they must consider whether it is a payable proposition to get the paddocks cleaned up and thus improve their subsequent crops, or whether they will continue to apply the same slovenly methods—methods which, so often, have ruled for several past decades.

Assuming that the grower has cleaned up his paddocks by the means suggested, it is, of course, a vital essential that only seed which is known to be free from all foreign seed should be sown. Mr. Gibson is emphatic on the point that the expenditure of a shilling or two more per bushel, when graded seed is in the balance, is money well spent. Clean paddocks are thus additionally assured.

Where wild oats are a pronounced difficulty it is possible that bare fallowing will not, in one season, secure the desired result, but the continuance of the fallowing, or the growing of a crop which requires inter-row cultivation, will go far in removing any volunteer growths of this character that remain.

Mr. Gibson says that the loss to Queensland wheatgrowers alone by the inclusion of wild oats, if it could be stated in figures, would be a staggering revelation to those producers who consider that wild oats can easily be cleaned from the resultant grain. They forget that buyers take the presence of the oats into consideration when fixing values, and therefore allow a lesser price for the wheat.

Canary seed-growers are deeply interested in the question of clean areas, as they know from experience that the cleaning of the seed, which is forwarded to the Canary Seed Board, is, in 98 per cent., if not in 100 per cent., of the cases, absolutely necessary before it can be classed as a merchantable article complying with the requirements of the Pure Seed Act. Here again farmers incur an overhead cost which can be largely reduced, and, the Director adds in conclusion: "It is to the attention of these growers that these comments are chiefly directed."

Butter Board Commended.

At the annual meeting of the South Burnett Co-operative Dairy Association at Murgon, the chairman, Mr. S. A. Heading, speaking on price stabilisation and an Australian price, said (vide "The South Burnett Times"):—"There is no question about it, Queensland leaders in the industry have done wonderful work in bringing about this position. Had it not been for Queensland leaders, it would not have come about. Mr. Chris. Sheehy has done wonderful work and has been responsible in a great measure for the formulation of the scheme. He moved a vote of thanks and congratulation to the Butter Board and Mr. Sheehy; they certainly deserved commendation." Mr. Mallon seconded the motion, which was carried unanimously.

Forage Poisoning—Care Necessary in Humid Weather.

Quite recently serious mortality from "botulism" or forage poisoning occurred among horses in the south-western district. Forage poisoning may be defined as a disease caused by eating foodstuffs which have become poisonous (toxic) through the growth in the fodder of a particular microbe, *Bacillus botulinus*. Horses are most commonly attacked, because of all classes of stock they are most commonly fed on prepared fodder, though cases in cattle are by no means uncommon, and even sheep and pigs may be affected at times.

This microbe is what is known as a saprophyte; that is, a microbe which may be found in soil, dust, or water, and ordinarily lives therein, gaining its nutriment from dead (decomposing) vegetable material. Being in the soil, the microbe easily gains access to such fodders as hay, chaff, and silage, per medium of the dust raised from the surface soil. It then requires suitable conditions of moisture and warmth in order to multiply, being in this matter much like a seed. This microbe is, of course, microscopic, and even when multiplying in fodder does not produce any recognisable changes.

Conditions which favour its growth also favour the growth of other micro-organisms, particularly moulds, and thus we frequently find it growing in mouldy fodder. Fodder which is simply mouldy, however, does not induce the disease we call forage poisoning, unless this particular microbe has been growing in and has produced its characteristic poison in such fodder.

An acute type of the disease follows where a large quantity of poison (toxin) has been absorbed. Characteristically its onset is sudden and its course rapid. Careful observation will reveal listlessness, slight inco-ordination in gait, and clumsiness in eating. Then follow the typical symptoms of "paralysis" of the tongue, and the muscles which perform the act of swallowing, salivation being marked at this stage. Following this paralysis the animal loses co-ordination of the limbs, and usually soon goes down. This may, in fact, on account of the non-observation of earlier symptoms, be the first thing noticed in very acute forms of the disease. There are no manifestations of pain, but the animal struggles ineffectively to regain its feet. Affected animals may lie on the ground for one to three or four days, depending upon the amount of toxin that has been absorbed. Finally, however, death supervenes, the animal being conscious almost to the end.

In the chronic form, termed "sleepy staggers," the animal is able to swallow small quantities of food provided it is moist, but has great difficulty in swallowing dry food. Mastication is extremely slow, and a proportion of the food drops from the mouth. Animals suffering from this form may live for weeks and gradually waste away, the abdomen assuming a pronounced "tucked-up" appearance.

This is another of those diseases in which the old adage, "prevention is better than cure," holds good. At the present time there is no method that can be relied upon for the successful treatment of affected animals, and stockowners should, therefore, keep the following points in mind when feeding:—

Foodstuff in which the microbe is found is usually mouldy.

Warm summer or autumn rains falling on fodder, followed by warm weather, may be responsible for the growth of the poison-producing microbe.

Of the several foodstuffs, that most prone to mould, e.g., silage, should be carefully guarded from the conditions which favour mould growth. Mouldy silage should not be fed on account of this risk, though not all mouldy silage is poisonous.

Should such damaged fodder overlie sound fodder, any toxin produced in the damaged fodder is liable to be washed through to the sound portion by rain.

Since there is not any means of determining which fodders are and which are not poisonous, one should, as far as possible, see (*a*) that only sound fodder is fed; (*b*) that where fodder is badly damaged, such damaged portions are burnt; and (*c*) that in order to minimise loss of fodder, proper care is taken in the protection of stacks, &c., from the effects of wet weather, and also the attacks by mice, since these are also likely to result in the growth of the microbe.—A. and P. Notes, N.S.W. Dept. Agric.

The Most Important Labour of Man.

Let us never forget that the cultivation of the earth is the most important labour of man. Unstable is the future of that country which has lost its taste for agriculture. If there is one lesson in history which is unmistakable, it is that national strength lies very near the soil.—Daniel Webster.

Progress in the Dawson and Callide Valleys.

"Agricultural development in particular, both in the Dawson Valley and Callide Valley Areas, has made very noticeable progress since my last visit to those parts of the State in 1930," said Mr. T. L. Williams, M.L.A., on his return from a recent visit to those areas and the Upper Burnett, in company with the Minister for Lands (Hon. P. Pease), who was paying his first official visit to those districts.

Particularly did this apply to the Theodore Irrigation Settlement Area, added Mr. Williams, where the majority of settlers were a happy and contented lot, and were gradually overcoming the initial difficulties that had been brought under his notice from time to time, when, on previous visits to the settlement in a journalistic capacity. The variety of crops being grown had extended, and, though the great problem of finding suitable and adequate near-by markets for the products grown had not been entirely solved, many individual settlers—the more self-reliant and progressive in spirit and methods, in particular—were in a position to place most of the output from their holdings, chiefly in Northern and Western centres, at prices showing reasonable profits, despite the generally low prices maintaining from time to time for the products grown—tomatoes, onions, pumpkins, eggs, chaff, and fodders, &c. Methods adopted in farming also showed a decided all-round improvement.

Dairying all along the Dawson Valley and Callide Valley branch lines had made wonderful strides during the past few years, he continued, and already the Wowan branch factory of the Port Curtis Co-operative Dairy Association, Limited, had well over 600 direct district suppliers, and a turnover of approximately 100 tons of butter a month at present. So great, in fact, has been the progress in the dairying industry in the Callide Valley Area alone, that a strong movement is afoot to secure the erection of a further branch factory of the company at some central point along the Callide Valley branch line, to meet the convenience of settlers engaged in dairying pursuits in that area alone.

Cotton was still one of the main crops grown, however, for which, of course, the district soils are so eminently suited in every way. In the Theodore Irrigation Settlement Area, almost every settler engages in the growing of cotton to a greater or lesser extent (both in the irrigable and the non-irrigable sections). The total area under that particular crop this season is estimated at approximately 1,500 acres, and in most instances, on present appearances, a record crop is anticipated.

Throughout the entire length of the two valleys in question, the total area under cotton this year will run into many thousands of acres, and as the season has been the most favourable for a number of years past, growers are confident of a record yield in most instances. Plants are flowering well and bolling freely, although in a number of places visited by the party rain was badly needed to promote and develop the young bolls. Shedding of the top squares, owing to lack of rain at the right moment, was noticeable in several parts of both districts, but given rain within the next week or two, further shedding of the middle and lower squaring systems would be arrested, and good general yields result, despite present unfavourable seasonable conditions referred to in the localities affected.

Feeding of Brood Sows.

At no season of the year is the feeding of the brood sows as important as it is during the humid weather of wet seasons and during the summer and early autumn months when weather conditions are usually unfavourable for taking necessary exercise, and when there is a tendency for the animals to seek a cool spot and spend most of the time lying about. Such a tendency is exaggerated when the animals are overfat and heavily fed, and especially when the food is of a heavy bulky nature. For best results brood sows should be kept in medium breeding condition, and especially at the time the sow is mated it is important that she be not overfat. The use of properly balanced rations is important, and the sow should be kept in good healthy condition by the free use of succulent green food and by being compelled to do a certain amount of foraging for her own living. Sows need plenty of clean drinking water, some mineral matters like burned corn cores, burnt or charred bones, a lump of rock salt to lick and regular and sufficient meals. It is better to have sows in medium breeding condition, for overfat sows are invariably clumsy and inactive at farrowing time and they rarely make a good job of suckling their young pigs. It is important that the food be appetising and succulent in order that the digestive tract be maintained in healthy condition, for constipation and other disorders of the bowels are disastrous and are responsible for loss of many valuable animals each year. If the sows are worth keeping at all they are worth caring for properly, and no effort should be spared to give them all the attention possible.

The Home and the Garden.

OUR BABIES.

(Issued by the Queensland Baby Clinics.)

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

A TRAVELLING padre in Central Australia has recently published two interesting books of his experiences in his vast but scantily populated parish. These are full of true yarns showing him to be an acute but sympathetic observer of human nature, with a strong sense of humour. One of them deserves quotation.

THE BABY AND THE COCKATOO.

The boarding-house was presided over by a young woman lately come from one of the big cities, and she had ideas of her own, which were not in accordance with the ways of the bush. She was an excellent cook and a good housekeeper, but her ignorance of many important things was abysmal. What she lacked in knowledge she made up in self-satisfied assurance. Consequently few offered her advice.

This young married woman had a baby. The baby had a small undernourished body and a loud and continuous wail. There was also a cockatoo, which, getting such frequent lessons, learnt to imitate the baby's wail to perfection; so much so, that when the baby and bird were at opposite ends of the house, and the mother in between, she was quite unable to distinguish between the infant and the bird. This, to say the least of it, was distracting, and caused her much unnecessary running about.

At last in desperation the mother took the baby across to Granny McGill.

Oh, Granny! I don't know what's the matter with the baby. I'm afraid she's fearfully ill. She cries and cries and nothing will pacify her. I'm sure she's sick.

Sick! Fiddlesticks, woman! replied Granny, tartly; all that's wrong is that you're ignorant and the baby's hungry.

But she can't be, Granny. I feed her regularly.

H'm! sniffed Granny. What do you give it?

Why, I give her a teaspoonful of condensed milk in a cup of warm water three times a day.

The old lady stared at the mother unbelievingly. A teaspoonful of condensed milk three times————. She broke off in disgust. Here give me the child. I'll teach you how to feed it, and muttering something about ignorant fools having the care of babies, set about preparing an adequate meal for the child. Half an hour later, while the contented babe slept peacefully on her ample lap, Granny gave the younger woman some plainly expressed advice.

The chastened mother took the sleeping baby and went home, and it became noticeable that as the cockatoo dropt the wailing for want of an example, the young woman became less opinionated and sought advice when she needed it.

We do not think the baby, who was being slowly starved, appreciated the humour of the situation. Lest some of our readers may draw a wrong conclusion, we must warn them that more babies cry from overfeeding than from underfeeding. These are not being starved, but are in constant torment from overloaded stomach and bowels. Being stronger than the starved babies, they cry much more loudly, and their mothers always think they are not getting enough.

This capable young woman from the big city had received a good State education. There must be something wrong with an education that turns out young women so unfitted for life.

RHUBARB PROPAGATION.

RHUBARB can be reproduced from seed or by subdividing the old plants. There are certain advantages to be gained from both methods, writes a departmental instructor in vegetable-growing in the New South Wales "Agricultural Gazette." rhubarb is open pollinated, and unless care is taken in plant selection, a good deal of cross-pollination takes place. Commercial seed is usually mixed in character, with the result that the commercial stalks are not uniform. It has been found, however, that rhubarb usually gives much quicker and heavier yields when grown from seed. On the other hand, if the crop is reproduced from a subdivided crown, a crop uniform in character will be produced, and this type of reproduction is less laborious and more reliable than the seed method.

Being a heavy feeding crop, rhubarb demands an abundance of readily available plant food and soil moisture. The crop does best in a free-working alluvial loam, which is well drained. Commercial growers obtain excellent results by digging into the soil up to 100 tons per acre of organic manure, and later force-feeding the crop with artificial fertilisers. Although trials have not been carried out with rhubarb, the indications are that a mixture of blood and bone two parts, superphosphate two parts, and sulphate of ammonia one part, at 10 cwt. per acre, would be the best fertilizer mixture to use. When the crop starts to "pull," the quality of the following stalks can be improved by top-dressing with liquid organic manure.

In the intense culture areas around Sydney, the most successful growers produce rhubarb by the seed method. Their practice is to force the growth, "pull" heavily and destroy the crop at the end of the season. When grown on a wider scale the "split" crown system of propagating is used. The crop is forced, "pulled" heavily for a period, but allowed to develop mature leaves in order to allow the crown to recover for the development of workable stalks at a later date.

The marketing of rhubarb calls for a good deal of attention to detail if the best prices are to be obtained. In the first place. leaves which are damaged and turning brown, or those with split stems, should be discarded. The stalks should be sorted into various grades, according to their length, colour, and diameter. The best prices are always realised for large thick stems of a red colour.

The method of marketing is to pack the stems into bundles, which are rectangular in cross sections; these are made by packing in a small frame 5 inches wide. It will often be found that some of the best stems are bent and cannot be packed when fresh. Experienced growers usually allow these bent stalks to remain in the sun until they become supple, and, after packing, the stems are placed in water, where they quickly regain their crispness and freshness.

The best varieties are Ruby Red, Emu Plains Red, and Tops Winter.

A UTILITY GARDEN.

Possibilities of Establishment in Dry Districts.

In choosing as the subject of his paper the establishing of utility gardens in dry districts, said Mr. W. A. Ellis, at a meeting of the Euratha branch of the New South Wales Agricultural Bureau, he had had in mind the importance of vegetables in the diet and the difficulty in obtaining supplies. Food for the body, however, was not man's only need, and no such garden could be regarded as complete without flowers.

"Too many of us are inclined to think in terms of wheat and wheat only," observed the speaker. "Take a journey by road from here in any direction you please, keep your eyes open and notice the homes you pass. You will find in a few instances a well-kept garden, flowers blooming, a plentiful supply of fresh vegetables, and the refreshing green of fruit trees and shelter belts. In a few cases the owner has become discouraged for some reason or other, and there is just the shadow of what might have been a decent garden. But in far too many instances you will see a house dumped in a bare paddock; no attempt has been made to grow a few flowers or vegetables, and there is not a living tree in sight.

"There is no excuse, however. We have the soil, which is capable of growing almost anything. Stable manure is available in tons, when it is not allowed to blow away. Water is rather a difficult problem, but one which can be overcome. The only other requirements are a little energy and foresight on the part of the farmer and his family."

Orchard Notes for May.

THE COASTAL DISTRICTS.

IN these notes for the past two months the attention of citrus-growers has been called to the extreme importance of their taking every possible care in gathering, handling, packing, and marketing, as the heavy losses that frequently occur in Southern shipments can only be prevented by so treating the fruit that it is not bruised or otherwise injured. It has been pointed out that no citrus fruit in which the skin is perfect and free from injury of any kind can become speckled or blue-mouldy, as the fungus causing the trouble cannot obtain an entry into any fruit in which the skin is intact. Growers are, therefore, again warned of the risk they run by sending blemished fruit South, and are urged to exercise the greatest care in the handling of their fruit. No sounder advice has been given in these notes than that dealing with the gathering, handling, grading, packing, and marketing, not only of citrus, but of all other classes of fruit.

It is equally as important to know how to dispose of fruit to the best advantage as it is to know how to grow it. To say the least, it is very bad business to go to the expense of planting and caring for an orchard until it becomes productive and then neglect to take the necessary care in the marketing of the resultant crop. Main crop lemons should be cut and cured now, instead of being allowed to remain on the tree to develop thick skins and coarseness. As soon as the fruit shows the first signs of colour or is large enough to cure down to about from 2¼ to 2½ inches in diameter, it should be picked, care being taken to handle it very gently, as the secret of successfully curing and keeping this fruit is to see that the skin is not injured in the slightest, as even very slight injuries induce decay or specking. All citrus fruits must be sweated for at least seven days before being sent to the Southern States, as this permits of the majority of specky or fly-infested fruits being rejected. Citrus trees may be planted during this month, provided the land has been properly prepared and is in a fit state to receive them; if not, it is better to delay the planting till the land is right.

In planting, always see that the ground immediately below the base of the tree is well broken up, so that the main roots can penetrate deeply into the soil and not run on the surface. If this is done and the trees are planted so that the roots are given a downward tendency, and all roots tending to grow on or near the surface are removed, the tree will have a much better hold of the soil and, owing to the absence of purely surface roots, the land can be kept well and deeply cultivated, and be thus able to retain an adequate supply of moisture in dry periods. Do not forget to prune well back when planting, or to cut away all broken roots.

All orchards, pineapple and banana plantations should be kept clean and free from all weed growth, and the soil should be well worked so as to retain moisture.

Custard apples will be coming forward in quantity, and the greatest care should be taken to see that they are properly graded and packed for the Southern markets, only one layer of one-sized fruit being packed in the special cases provided for this fruit—cases which permit of the packing of fruit ranging from 4 to 6 in. diameter in a single layer.

Slowly acting manures—such as meatworks manure—may be applied to orchards and vineyards during the month; and lime can be applied where necessary. Land intended for planting with pineapples or bananas during the coming spring can be got ready now, as, in the case of pineapples, it is a good plan to allow the land to lie fallow and sweeten for some time before planting; and, in the case of bananas, scrub fallen now gets a good chance of drying thoroughly before it is fired in spring, a good burn being thus secured.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

CLEAN up all orchards and vineyards, destroy all weeds and rubbish likely to harbour fruit pests of any kind, and keep the surface of the soil well stirred, so as to give birds and predaceous insects every chance to destroy any fruit fly pupæ which may be harbouring in the soil. If this is done, many pests that would otherwise find shelter and thus be able to live through the winter will be exposed to both natural enemies and cold.

Further, it is a good plan to clean up the land before pruning takes place, as, if delayed till the pruning has been finished, the land is apt to dry out.

Pruning can be started on such varieties as have shed their leaves towards the end of the month, as it is a good plan to get this work through as early in the season as possible, instead of putting it off until spring. Early-pruned trees develop their buds better than those pruned late in the season. These remarks refer to trees—*not*

vines, as the later vines are pruned in the season the better in the Granite Belt district, as late-pruned vines stand a better chance to escape injury by late spring frosts.

All worthless, badly diseased, or worn-out trees that are no longer profitable, and which are not worth working over, should be taken out now and burnt, as they are only a menace and a harbour for pests.

Land intended for planting should be got ready as soon as possible, as, if ploughed up roughly and allowed to remain exposed to the winter frosts, it will become sweetened and the trees planted in it will come away much better than if set out in raw land. In any case the land must be properly prepared, for once the trees are planted it is a difficult matter to get the whole of the land as well worked as is possible prior to planting.

Slowly acting manure—such as ground island phosphates or basic phosphates—may be applied to orchards and vineyards. They are not easily washed out of the soil, and will become slowly available and thus ready for use of the trees or vines during their spring growth. Lime may also be applied where necessary.

This is a good time to attend to any drains—surface, cut-off, or underground. The two former should be cleaned out, and in the case of the latter all outlets should be examined to see that they are quite clear and that there is a good getaway for the drainage water. New drains may also be put in where required.

In the warmer parts citrus fruits will be ready for marketing, and lemons ready for cutting and curing. The same advice that has been given with respect to coast-grown fruit applies equally to that grown inland; and growers will find that careful handling of the fruit will pay them well. Lemons grown inland are, as a rule, of superior quality to those grown on the coast, but are apt to become too large if left too long on the trees, so it is advisable to cut and cure them as soon as they are ready. If this is done and they are properly handled, they may be kept for months, and will be equal to any that are imported.

If the weather is very dry, citrus trees may require an irrigation, but, unless the trees are showing signs of distress, it is better to depend on the cultivation of the soil to retain the necessary moisture, as the application of water now is apt to cause the fruit to become soft and puffy, so that it will not keep or carry well.

Land intended for new orchards should be got ready at once, as it is advisable to plant fairly early in the season in order that the trees may become established before the weather again becomes hot and dry. If the ground is dry at the time of planting, set the trees in the usual manner and cover the roots with a little soil; then give them a good soaking; and, when the water has soaked into the soil, fill the hole with dry soil. This is much better than surface watering.

Farm Notes for May.

FIELD.—May is usually a busy month with the farmer—more particularly the wheatgrower, with whom the final preparation of his land prior to sowing is the one important operation. Late-maturing varieties should be in the ground by the middle of the month at the latest.

Clover land, intended primarily for feeding off, should be sown not later than the end of April.

The necessity of pickling all wheat intended for sowing purposes is again emphasised; and for general purposes, combined with economy in cost of material, the bluestone and lime solution holds its own. To those who desire an easier but somewhat more costly method of treatment, carbonate of copper at the rate of 1 oz. to the bushel and used in a dry form is suggested.

Potatoes, which in many districts are still somewhat backward, should have by this time received their final cultivation and hilling-up.

The sowing of prairie grass on scrub areas may be continued, but should be finished this month. This is an excellent winter grass, and does well in many parts of Southern Queensland.

Root crops, sowings of which were made during April, should now receive special attention in the matter of thinning out and keeping the soil surface well tilled to prevent undue evaporation of moisture.

Every effort should be made to secure sufficient supplies of fodder for stock during the winter, conserved either in the form of silage or hay.

Cotton crops are now fast approaching the final stages of harvesting. All consignments to the ginnery should be legibly branded with the owner's initials. In this matter the consignor is usually most careless, causing much delay and trouble in identifying parcels, which are frequently received minus the address labels.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

Table showing the Average Rainfall for the Month of February, in the Agricultural Districts, together with Total Rainfall during February, 1934, and 1933, for Comparison.

Divisions and Stations.	Average Rainfall. Feb.,	Average Rainfall. No. of Years' Records.	Total Rainfall. Feb., 1934.	Total Rainfall. Feb., 1933.
North Coast.	In.		In.	In.
Atherton	10·35	33	18·80	19·22
Cairns	15·58	52	22·75	32·75
Cardwell	16·79	62	12·96	17·74
Cooktown	13·63	58	21·42	28·60
Herberton	7·74	48	19·07	13·27
Ingham	16·02	42	16·69	18·17
Innisfail	22·36	53	28·45	41·68
Mossman Mill	17·46	21	33·95	26·46
Townsville	11·11	63	14·19	10·03
Central Coast.				
Ayr	8·86	47	12·57	7·89
Bowen	8·65	63	12·69	9·67
Charters Towers	4·40	52	7·02	6·34
Mackay	11·39	63	11·76	19·86
Proserpine	11·93	31	14·22	12·68
St. Lawrence	7·79	63	11·76	1·86
South Coast.				
Biggenden	4·33	35	11·29	1·85
Bundaberg	6·40	51	19·26	4·90
Brisbane	6·41	83	16·16	2·44
Caboolture	7·74	47	16·95	3·62
Childers	6·55	39	21·54	4·15
Crohamhurst	12·95	41	18·11	4·08
Esk	5·52	47	8·96	3·93
Gayndah	4·21	63	8·58	1·71
Gympie	6·66	64	18·83	3·85
Kilkivan	4·88	55	12·91	1·39
Maryborough	6·65	63	21·16	5·38
Nambour	9·60	38	15·62	4·65
Nanango	4·12	52	5·45	2·44
Rockhampton	7·68	63	16·27	1·67
Woodford	8·50	47	13·21	3·70

Divisions and Stations.	Average Rainfall. Feb.,	Average Rainfall. No. of Years' Records.	Total Rainfall. Feb., 1934.	Total Rainfall. Feb., 1933.
Central Highlands.	In.		In.	In.
Clermont	4·24	63	6·13	3·84
Gindie	2·72	35	0	0·53
Springsure	3·92	65	3·56	0·79
Darling Downs.				
Dalby	2·86	64	4·42	2·96
Emu Vale	2·56	38	2·46	1·52
Hermitage	2·50	28	0	2·13
Jimbour	2·64	46	4·48	2·59
Miles	2·71	49	4·82	1·88
Stanthorpe	3·21	61	2·53	1·40
Toowoomba	4·50	62	10·88	2·58
Warwick	3·08	69	3·35	2·02
Maranoa.				
Roma	2·93	60	3·60	0·98
State Farms, &c.				
Bungeworgorai	2·15	20	3·62	0·83
Gatton College	3·45	35	0	2·89
Kairi	9·76	20	14·51	17·73
Mackay Sugar Experiment Station	10·39	37	9·28	20·92

GEORGE G. BOND, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—FEBRUARY, 1934.

Compiled from Telegraphic Reports.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature. Means. Max.	Means. Min.	Extremes. Max.	Extremes. Date.	Extremes. Min.	Extremes. Date.	Rainfall. Total.	Rainfall. Wet Days.
Coastal.	In.	Deg.		Deg.		Deg.		Points.	
Cooktown	29·80	86	74	94	5	70	5	2,142	25
Herberton	..	77	64	86	5	60	5, 6	1,907	21
Rockhampton	29·91	87	71	97	4	66	21	1,627	10
Brisbane	29·97	83	67	93	4	62	10	1,616	10
Darling Downs.									
Dalby	29·94	85	63	92	15, 25	55	8	442	8
Stanthorpe	..	78	57	85	15	48	4	253	9
Toowoomba	..	77	61	85	15, 4	52	4	1,088	9
Mid-interior.									
Georgetown	29·82	89	71	96	8	66	1, 2, 3	1,172	14
Longreach	29·85	94	69	105	6	64	21	190	5
Mitchell	29·91	89	64	97	16	54	5	311	7
Western.									
Burketown	29·80	89	75	101	5	67	2	314	11
Boulia	29·81	96	74	105	8	67	20	732	3
Thargomindah	29·85	96	72	104	25, 28	63	10	63	6

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	April, 1934.		May, 1934.		MOONRISE. April, 1934.	MOONRISE. May, 1934.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	6·2	5·50	6·19	5·19	6·17	6·27
2	6·3	5·49	6·20	5·18	6·55	7·27
3	6·3	5·48	6·20	5·18	7·41	8·31
4	6·4	5·47	6·21	5·17	8·35	9·37
5	6·4	5·46	6·21	5·17	9·35	10·44
6	6·5	5·45	6·22	5·16	10·39	11·48
7	6·6	5·43	6·22	5·16	11·45	a.m.
8	6·6	5·42	6·23	5·15	..	12·54
					a.m.	
9	6·7	5·41	6·23	5·14	12·53	1·57
10	6·8	5·40	6·24	5·13	1·57	2·56
11	6·8	5·38	6·24	5·13	3·1	3·55
12	6·9	5·37	6·25	5·12	4·4	4·53
13	6·9	5·36	6·25	5·11	5·4	5 55
14	6·10	5·35	6·26	5·11	6·3	6·55
15	6·10	5·34	6·26	5·10	7·3	7·51
16	6·11	5·33	6·27	5·9	8·6	8·45
17	6·11	5·32	6·28	5·9	9·5	9·36
18	6·12	5·31	6·28	5·8	10·1	10·23
19	6·12	5·30	6·29	5·8	10·53	11·3
20	6·13	5·29	6·29	5·8	11·43	11·37
					p.m.	p.m.
21	6·13	5·28	6·30	5·7	12·28	12·9
22	6·14	5·27	6·30	5·7	1·6	12·39
23	6·14	5·27	6·31	5·7	1·39	1·7
24	6·15	5·26	6·32	5·6	2·11	1·37
25	6·15	5·25	6·32	5·6	2·40	2·10
26	6·16	5·25	6·33	5·5	3·10	2·44
27	6·16	5·24	6·34	5·5	3·41	3·24
28	6·17	5·24	6·34	5·4	4·14	4·12
29	6.17	5.23	6·35	5·4	4·51	5·10
30	6·18	5·22	6·35	5·3	5·35	6·14
31	..	..	6·36	5·2	..	7·23

Phases of the Moon, Occultations, &c.

7 April	☽	Last Quarter	10 48 a.m.
14 ,,	●	New Moon	9 57 a.m.
22 ,,	☾	First Quarter	7 20 a.m.
29 ,,	○	Full Moon	10 45 p.m.

Perigee, 7th April, at 9.12 p.m.
Apogee, 21st April, at 11.42 p.m.

Mercury will be at its greatest elongation, 28 degrees west, on 2nd April.

Saturn will be in conjunction with the Moon on the 10th at 6 a.m., an hour earlier the Moon will be about its own diameter west of Saturn; both will be near the border of Capricornus and Aquarius and about half-way to the meridian. The more brilliant planet Venus will be visible in the coming daylight about 7 degrees further east and will be occulted by the Moon about 4 hours after both have gone over the western horizon.

As Mars will be in conjunction with the Sun on the 14th it may be said to have left the evening sky during this month.

On the 16th Venus will be at its greatest elongation, 46 degrees west of the Sun, and will be more than half-way to the meridian at Sunrise.

The conjunction of Jupiter with the Moon, on the 28th, will occur at midday when both are high up (two hours west of the meridian.)

Mercury rises at 3.56 a.m. and sets at 4.36 p.m. on 1st April; on the 15th it rises at 2.40 a.m. and sets at 3.20 p.m.

Venus rises at 2.37 a.m. and sets at 3.21 p.m. on the 1st; on the 15th it rises at 2.40 a.m. and sets at 3.20 p.m.

Mars will set 11 minutes after the Sun on the 1st, with the Sun on the 14th, and one minute after it on the 15th.

Jupiter rises at 6.15 p.m. and sets at 6.47 a.m. on the 1st; on the 15th it rises at 5.14 p.m. and sets at 5.44 a.m.

Saturn rises at 2.31 a.m. and sets at 3.41 p.m. on the 1st; on the 15th it rises at 1.41 a.m. and sets at 6.51 p.m.

Jupiter, which will be in opposition to the Sun on the 8th, will rise as the Sun sets and set as the Sun rises, if we ignore the more exact changes per second which will take place every moment, owing to the velocity, 8.1 miles per second of Jupiter and 18·5 miles per second of the Earth.

Mercury's path will be in Aquarius and Pisces; that of Venus from the border of Aquarius to the border of Pisces; Mars from Pisces into Aries; Jupiter will continue retrograde motion in Virgo, away from Spica; Saturn in Aquarius from Right Ascension 21·49 to R.A. 21·58.

6 May.	☽	Last Quarter	4 41 p.m.
13 ,,	●	New Moon	10 30 p.m.
22 ,,	☾	First Quarter	1 20 a.m.
29 ,,	○	Full Moon	7 41 a.m.

Apogee, 19th May, at 5.54 a.m.
Perigee, 31st May, at 5.12 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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QUEENSLAND AGRICULTURAL JOURNAL

VOL. XLI. | 1 MAY, 1934. | PART 5.

Event and Comment.

Anzac.

ANZAC DAY remains one of our most inspiring anniversaries, and even after the lapse of less than a score of years the Epic of Gallipoli has already become a great and glowing tradition of our race. In our observance of Anzac Day, which this year as in previous years was Australia-wide, one senses the vital element that keeps Australia true, not only to herself but also true to the traditions of the British peoples from whom we are proud to claim descent. Anzac Day will continue to hold its place in history. We have come to regard it not only as a day of reverent memory of the poignant tragedies of war, but a day on which our sense of spiritual values is strengthened by a contemplation of the invincible valour, the service, and the sacrifice of the men who set out on a great adventure and did not come home. Theirs was a venture of courage, and their courage never failed; theirs was a venture of faith, and their faith remains undimmed—an inspiration, surely, for us to face the perplexing problems of the present with something of the same strong faith and courage.

The spirit of Anzac is, after all, only an expression of the spirit of the pioneers of this country. That spirit is equally our inheritance to-day. So while honouring the men who gave their all for Australia in the war with deep reverence and respect, let us not forget that Australia calls to-day just as insistently for service as she did in 1914—a service we cannot deny her, a service that certainly was not denied her by her youth of yester-year who died in her defence.

Problems of Rural Development.

DEPARTMENTAL reports are usually regarded as dry and uninspiring documents, yet, rightly read, there is a wealth of interesting matter, even romance, in these reports that have so much to record of the building-up of a rural civilisation in Queensland. Reports, say, of the Department of Agriculture and Stock, of the Department of Public Instruction, and of the Main Roads Commission—to mention only a few—are all worth reading. The Annual Report of the Department of Agriculture and Stock deals with real problems of rural development. It shows that both primary and secondary industries are interwoven and inter-related to such an extent that it is scarcely possible to disengage them. And this fact shows the necessity of our determining and maintaining a balance between them if the country generally is to prosper. There is, however, a difference between the agricultural and manufacturing industries as they are now developed, particularly in regard to proper price relationship in respect of one commodity and another. Manufacturers can restore or adjust matters affecting prices and other economic factors by modernising their methods, reducing costs, discharging labour, introducing new machinery, and changing their product; or even getting out into other fields which can be done, not easily, certainly, but with comparative facility. In agriculture, on the other hand—with its numerous scattered units, its unrelated establishments, its small proportion of outside labour, its relatively large fixed capital, its slow turnover, its combination of business and industry with home and social life, its lack of flexibility in organisation, the perishability of its products, its dependence on the weather, and time as an irreducible factor—adjustment is slow and difficult. Since the manufacturer can reckon on a fairly quick adjustment of production to demand, he can, when prices drop, cut his costs with some confidence that in that way he will find, at least, temporary economic salvation. The farmer cannot do that to any appreciable extent. As an individual he has very little chance of cutting his costs, except by increasing production. He may, of course, cut out waste in production; but agricultural production is fundamentally a biological, not a mechanical, process which requires a fixed period of time; so that costs can be reduced only by increasing production in this period, and not by reducing the time required for the crop. Then, if the farmer increases production per acre of a commodity for which there is already a glutted market, prices will probably fall still further. Any plan for improving the conditions of our country life must, therefore, be considered in the light of these fundamental facts, in the light of the essential differences, notwithstanding their economic relationship, between urban and rural industries. The first is governed by fixed principles of mechanism and organisation, while agriculture is controlled entirely by natural conditions, seasonal circumstances, and so forth. So we come to this point: If we are to improve agriculture we have to get right down to business. With any increase in production must go extension of markets and the improvement in marketing facilities, transport, and so on.

And then we come to the question of farm efficiency. In manufacturing the inefficient producer generally goes to the wall unless his business is bottle-fed, or his commercial life is artificially prolonged by outside assistance—and probably at the expense of some other industry or organisation. In agriculture the inefficient producer may still, like

a poddy calf, remain on the bucket indefinitely, to the general detriment of the industry. All this is merely suggestive of the problems of building up our rural civilisation through agriculture, which are discussed, in one form or another, every year in the Agricultural Report.

Home Project Clubs.

COMING now to the work of the Department of Public Instruction, there is nothing in its last report more impressive than the section on Home Project Clubs, unless it be that descriptive of the success of the Correspondence Courses, whereby modern education is brought to the loneliest youngster in the remotest part of the State. That great service has certainly become one of the most important factors in the building up of a rural civilisation in Queensland. To quote from the report directly—

> The School and Home Project movement is one of the few departmental activities which, during this time of restricted funds and consequent non-expansion, it has yet been possible for the department to continue to develop. The growth of this movement is at once a tribute to and the result of teachers' and parents' appreciation of the educational and economic values claimed for the Project scheme at the time of its introduction and since. In country districts and even in urban schools it is becoming more and more realised that no school activity provides a richer field for responsible exercise in honest thinking and judgment-formation than does agriculture worked and studied on the Project plan.
>
> For the most part, teachers and clubs select projects which are agricultural in nature; yet, agricultural though the project is, the fact that the agricultural product is relatively unimportant, while the child—the member—is all-important, is becoming more and more appreciated by teachers; inherent educational values are becoming more and more recognised. Though the immediate purpose of club work is educational, teachers are still conscious that the children of to-day are the responsible citizens of to-morrow, and that from an educated, observant, reasoning youth economic benefits will in due course come.

The Broad Highway.

THE Report of the Main Roads Commission is a survey of a year's achievements that leaves the impression that the Commission is one of the most important factors in our rural development. One of the most important aspects of the history of civilisation is the development of the road for, in a very real sense, "transportation is civilisation." The literature of the road is curiously scanty. It provides the commonest of metaphors, but is one of the rarest of subjects. Poetry, imaginative prose, religion itself, would lose much if they were deprived of such convenient symbols as the broad, high road, the narrow path, the beaten track, the accustomed way, and the slippery slide to perdition. Civilisation "begins with wandering trails in the dim mists of pre history"; its present stage is the construction of solid concrete or bitumen highways reserved for fast motor traffic; between the two lies the material history of mankind. As a factor in rural development of Queensland, the importance of a sound main road policy is thus obvious to all who care to give the subject a single thought.

Queensland Citrus Scale Insects and their Control.

By W. A. T. SUMMERVILLE, M.Sc., Assistant Entomologist.

THIS report is primarily the result of investigations carried out during the past three years. For several years prior to the commencement of active investigational work, however, extensive observations on citrus scale insects were made whilst research work on other pests of this plant was being prosecuted. The conclusions arrived at and here presented are therefore based on work carried on over a considerable number of years.

Commonly, the problem of scale insect control on citrus in this State is not a simple one, but is complicated by the frequent occurrence of mixed populations of the scales themselves and by the necessity of using artificial methods of control for other pests and diseases. In the present state of knowledge, when the treatment for a scale insect materially affects or is affected by the recommended method of control of several other pests and major diseases, it is the scale insect treatment which must be varied if at all possible. Thus it becomes necessary to take into account the influence of other operations on the scale insect position, and questions of compatability of sprays and following treatments must be considered.

Whilst the control of almost any pest is influenced by many factors not specifically assignable to the insect in its simple relationship to the host, with no other pest or group of pests to which citrus in Queensland is subject are these "outside" factors of such great direct importance. When the habits of a pest are known it is often possible to anticipate a position, and anticipation usually means that the solution of the problem is facilitated. It is advisable, therefore, that growers familiarise themselves with the habits of each of the important species under different conditions. To do this some knowledge of the biology of the insects is necessary, and for this reason the first section of this report is devoted to an account of the rudiments of their biology.

Many growers are content to know that good results may be obtained against a particular pest with a certain insecticide. Fortunately, however, an increasing number are realising the inadequacy of that amount of knowledge, and time of application is being recognised as an important factor in the successful control of many pests. Time of application can seldom be accurately stated in terms of a calendar, though some indication may be given in that way. This is particularly true of citrus insects in Queensland. Here commercial citrus-growing areas are scattered over an area of almost 200,000 square miles, and variations in climate, which are reflected in the development of the pests, are only to be expected. It is necessary, therefore, to refer to times of application of control measures as taking place at a certain stage in the life history of the insect. Growers accordingly will always need to carry out observations on certain details for themselves, and here again a knowledge of the habits and biology of the pest will be of

considerable benefit. It will be quickly found that by making observations and interpreting what is seen in terms of the information given below much better results will be obtained than by the most slavish adherence to any generalised recommendations.

THE BIOLOGY OF THE SCALE INSECTS.

The forms and appearances assumed by the different species vary enormously, and it would be very difficult to compile a short and simple description which would enable orchardists to recognise an insect from its external appearance as being a member of the group known as scale insects or Coccidæ. In fact, in making almost any generalised statement concerning these insects, variations and exceptions at once come to mind, and if only those exceptions which apply to the particular species known to feed on citrus in this State were to be included, a description would be necessarily long and rather involved. This account is accordingly intended merely to give orchardists the facts of outstanding importance and interest which will enable them to obtain a working understanding of the group.

Whilst no short account can be given, it may be said that the whole range of forms is so different from those of other insects that scale insects can usually be readily recognised as such, once one has become familiar with a few species.

The Scale Covering.

In the majority of cases there is little to suggest the insect nature of the pest. In many cases the insect itself is not seen from the outside, as the body is entirely hidden from view beneath a secretion exuded by the insect. This secretion often forms a scale-like covering, and it is from this structure that the vernacular name is derived. The scale secretion may be one of many forms; for example, in the female red scale, *Aonidiella aurantii* (Maskell), it is circular, almost flat, somewhat parchment-like in consistency, and almost transparent (Plate 122), whilst in the white wax scale, *Ceroplastes destructor* Newstead, the covering is a thick waxy substance, rather irregular, though fairly constant, in shape, and almost as high as long. The shape of the covering at times gives little clue to the shape of the insect beneath it, but in general the sizes are comparable. In addition to this scale covering the upper surface a second scale may be found on the under or ventral surface. This ventral scale is commonly thin and transparent and very easily ruptured.

Some species do not secrete a "scale" at all, but in so far as the female is concerned remain naked throughout life. These naked species are commonly referred to as "soft" or "unarmoured" scales (Plate 126) in contradistinction to the armoured species described above. In these soft scales the exposed surface or dorsal derm is usually much thickened and hardened. Even with these naked species the resemblance to other insects is often remote, but they may perhaps be likened somewhat to a small tick.

For the most part the scale insects remain practically stationary on the plant once they have settled down and commenced to feed, but some, particularly those belonging to the mealy bug group, move freely about their host plant.

Reproduction.

The adult females, according to the species, either produce eggs or give birth to living young. When eggs are produced these may be deposited loosely beneath the body of the mother, and in these cases the body may shrivel or shrink up against the upper or dorsal surface so that the eggs ultimately occupy almost the whole of the cavity formed by the upper surface and the plant surface or the ventral scale. Certain species deposit their eggs in specially produced structures, which are more or less bag-like and are termed ovisacs. These ovisacs (Plate 127, fig. 1) vary greatly in detailed structure, but in so far as the citrus scales which produce them are concerned may be described briefly as cottony or floury bags. It is characteristic of these insects that there is one continuous period of reproduction. This period may be protracted, but in all cases observed, once the continuity has been broken there is no resumption, and the old female invariably dies very soon after completion of this work.

The Young Scales.

When first emerged from the egg or mother the young of many species of scale insects are difficult to differentiate, and there is commonly no discernible differences between the two sexes. In general the young are minute soft-bodied creatures, very pale green, creamy yellow, or almost transparent in appearance, and are equipped with six comparatively well developed and conspicuous legs. The antennæ or feelers are also usually large compared with the size of the insect itself. In this stage the insects are well described by the vernacular name of "crawlers" (Plate 127, fig. 4). On emerging from beneath the covering provided by the mother, the young scatter to a greater or lesser degree according to species and circumstances. Some settle down almost at once, but others wander about for several days. When this wandering period is completed the insect has found a site at which to feed, and it settles down and becomes fixed to the plant, and, as has been said, for the most part the remainder of its life is spent in that place. This does not apply to the male, for with this sex, though the immature stages remain fixed, the adult is a free moving creature.

Moulting and Development.

With the armoured species, the secretion of the scale covering begins immediately feeding has commenced. The first covering protecting the young, however, may differ greatly in appearance and texture from the scale which appears later. From this time onwards the differences between species becomes more and more apparent. The insect grows by a series of moults, there apparently being two moults in the case of the females of every species. The moulted skins or exuviæ may be included in the covering, and in such cases can commonly be found at the anterior end, or towards the central point of circular species, of the scale as a conspicuously different area from the remainder of the covering. When incorporated in the covering in this way these cast skins are referred to as pellicles. After the second moult the sexes can be distinguished, and in many cases the males bear little or no resemblance to the females of the same species, even on external characters. Commonly, the male is considerably smaller than the female, and the scale covering may be quite different. In the case of the white louse scale, for example, the female has a drab, brown, somewhat mussel-shaped scale of rather leathery or thick parchment-like texture, while

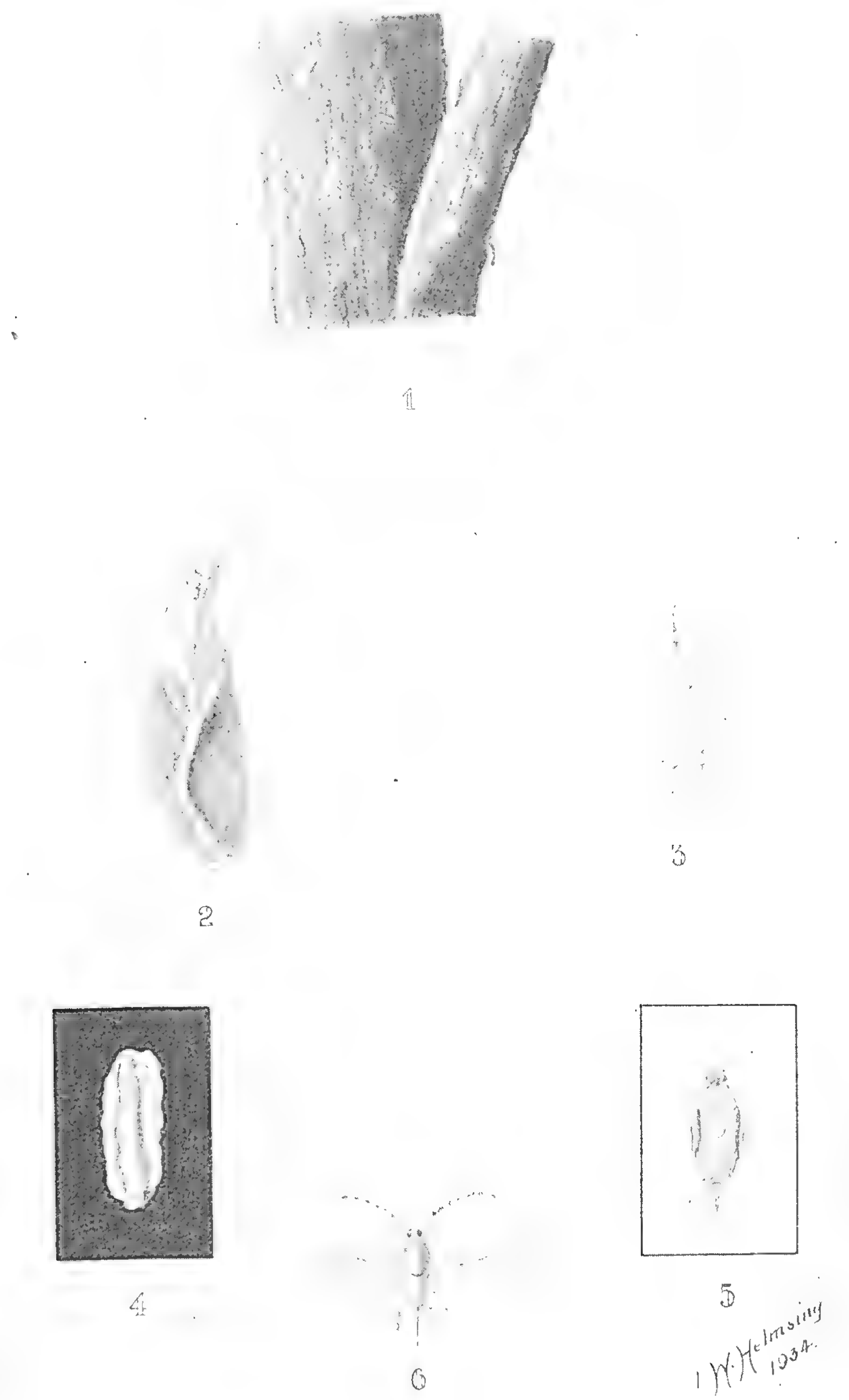

PLATE 121.

White Louse, *Chionaspis citri* Comstock. Fig. 1, Male tests on bark × 3. Fig. 2, Female test × 24. Fig. 3, Adult female × 24. Fig. 4, Male test × 24. Fig. 5, Male pupa × 24. Fig. 6, Adult male × 24.

the male scale is pure white, more or less cylindrical, deeply keeled and of somewhat cottony consistency. The differences in the insects themselves in all cases is even greater.

The Female Scale Insect.

The female (Plate 121, fig. 3) does not change very greatly in form during development, though usually it is more rounded in the later stages than when in the crawler form. The detailed structure may become much modified. The legs and antennæ may be lost or represented finally by minute stumps. In other species both legs and antennæ are retained throughout life, but even in such cases there is often some modification of the form of these organs.

The Male Scale Insect.

In the development of the male insect the changes are far more profound. In so far as those species which attack citrus are concerned, there are typically four moults in the development of the male insect. After the second moult the insect enters what is termed the prepupal stage. In this stage the characters are rather ill-defined unless viewed under high magnification, and can only be briefly described as indicative of those of the next or pupal stage. Even if the species be a naked one, at this time the males become enclosed in some form of investment comparable with the cocoon of a moth. Similarly the pupal stage (Plate 121, fig. 5) indicates the form of the adult in the same way as does the pupa or chrysalis of a moth. After the fourth moult the insect is perfect and ready to emerge. On emergence the adult male (Plate 121, fig. 6) is found to be greatly different from its female. The male has a fine narrow body, long and very fine antennæ, generally conspicuous eyes, and the whole appearance suggests fragility. Typically, the adult male possesses a single pair of fine delicate wings which carry a single forked vein. Probably the most striking character of the male scale insect is that it is without mouth parts, these having disappeared during development. The adult male is therefore unable to feed, and is thus very short-lived. The great majority of males die within a few hours of emergence, and probably none live much longer than twenty-four hours at the most. Adult males are rarely found in the orchard, and certainly no one but a student of the group would recognise these delicate winged creatures as the consorts of the fixed, sluggish, fat-looking female scale insects.

Parthenogenesis.

Many species of scale insects are able to reproduce without the presence of a male, and in the case of some well-known species the male has never been discovered. With certain species the female may reproduce either with or without the assistance of the male.

Rate of Multiplication.

That scale insects are so important as pests is due to a very large extent to the rapidity of their development, together with the large number of young produced by each female. In some cases individual females give rise to more than 2,000 eggs, and though natural mortality is certainly very high, in most cases the number surviving is commonly so great that huge populations are quickly built up from but a small number of original insects.

Manner of Feeding.

Scale insects possess rather complicated mouth parts, which, however, may be briefly described as long, slender, piercing, and tubular. The most conspicuous feature of these organs is their length, which at times is much greater than that of the entire body of the insect. The plant is pierced and the tube inserted into the internal tissues and the food sucked up in fluid form. The manner of feeding is essentially the same as that of the plant bugs. The actual injury done can best be considered in conjunction with each species in so far as citrus is concerned. The general direct effects of such a sap-sucking insect need no description. The indirect effects, however, are often just as important, and these, though readily to be expected, are often overlooked. The weakening of parts resulting in the entrance of other insects and fungal parasites is commonly a most important consideration. Unfortunately, it happens all too frequently that growers do not become concerned about a pest until or unless it is obviously a menace to the crop, but it must be remembered that anything which interferes with the vigour of any part of the tree affects the crop.

FACTORS INFLUENCING THE INCIDENCE OF CITRUS SCALE INSECTS.

Influencing the incidence of citrus scale insects are dispersion, climatic, locality, soil, and plant factors, and the various natural enemies. These will be discussed in turn.

Dispersion Factors.

As will be readily understood from what has been written concerning their biology, the scale insects are largely dependent on external factors for dispersal. The only form which possesses wings is the adult male, which is of little or no consequence in the matter, and, furthermore, the wings are so delicate that migration for any appreciable distance could only take place under most favourable circumstances. The females are, of course, the important factor. In the first stage for a time these are free-moving, but they soon become fixed to the plant and are removed only with difficulty and great probability of injury to vital organs, particularly the mouth parts. Species such as the mealy bugs, which habitually move about the plant for the greatest part of their life, may, however, be transferred from tree to tree at almost any time except, perhaps, during the reproductive period, but with the great majority of scale insects it is only in the first few days after emergence that dispersal is at all likely to take place. At this time the larvæ are able to crawl well, but they are so minute that the distance between two trees in an orchard or between a native host plant and an orchard tree is, comparatively speaking, very great, and the likelihood of such small, soft, and defenceless creatures safely reaching a destination five yards away is very remote. Furthermore, tests were carried out with a number of common species, and in each case it was found that when placed on soil under a tree the crawlers meandered about apparently without sense of direction. In almost every case, after hours of crawling, each individual ultimately arrived at a point within a few inches of the one at which it commenced. It is thus evident that, unaided, there will be little change of scale insects from tree to tree. Crawling is of some importance in the distribution of the pests on the tree on which the mother reproduced, and this method of dispersal is of moment in

another matter. In the case of some species, such as red scale, for instance, the females may continue to reproduce freely on fruit stored before marketing. The young of these females may be disseminated through many boxes of fruit in this manner. This point is of importance to lemon-growers, and also in connection with the importation of some species from one district or country to another.

The minute first-stage larvæ are easily dislodged from a leaf or twig when they are in the crawling stage, and are consequently carried away by air currents, and it is chiefly by this means that many species are distributed. Naturally, the degree to which the winds effect transportation depends to a certain extent on the length of time the young are crawling about the plant before attaching themselves securely to it. This is very well shown in the cases of pink wax and red scale. The latter is one of the quickest citrus scales in the matter of settling down, whilst pink wax commonly moves about freely for several days. Wind distribution of pink wax is much more efficient than with the red species, which is, in fact, but slowly scattered by this means. It will be seen then that the direction of prevailing winds becomes a consideration in dealing with some species of scale pests, and it will be understood that in carrying out control operations against species distributed to an appreciable extent in this way from outside sources it may be wise to commence operations on the leeward face of the orchard.

The minute crawlers are at times carried from one tree to another on hands, clothes, secateurs, and other such tools which come in contact with various trees in quick succession.

The introduction of scale insects from one district to another usually only concerns the grower in respect to bringing young trees on to his orchard. This has undoubtedly been the means of establishing certain species in some parts in the first place, and it is always wise to procure trees from the cleanest possible nursery apart from the fact that the infested young tree must be adversely affected by the presence of heavy scale infestation.

Climatic Factors.

Climatic conditions exert a very marked influence on both the incidence and development of every species of citrus scale insect. The optimum conditions for each species will be dealt with later in connection with the individual species. In so far as the present discussion is concerned, however, there is one point to be stressed. The majority of citrus scales in Queensland are present in every major commercial citrus district. In normal times certain of these species will be found to be of little or no importance in one particular locality. However, very quick response to climatic conditions is characteristic of practically every species, and thus in an abnormal season the position in any orchard may be fundamentally changed. It is therefore wise for an orchardist to become familiar with the essential points concerning each species encountered, even though certain ones may be considered of no importance to him at present.

Where it is the custom to draw up in advance a spraying programme for the year, as is often advisable, the possible variation of climatic conditions must be kept in mind. Far too often growers use a spray simply because they obtained good results with it at that time the previous year. It is surprising, too, how frequently growers will purchase large quantities of some material months in advance, only to find

subsequently that this material is not needed. Unfortunately, the rule in such cases appears to be to use the material on hand, even though it is going to give no benefit, and at the same time to neglect to obtain the correct spray. This is sometimes the result of lack of knowledge in the first place as to what spray is to be used in certain circumstances, but most commonly it is due to failure to recognise that seasons vary from time to time, and that climatic factors exercise great influence on many pests, particularly scale insects.

Locality Factors.

Factors in scale incidence which arise out of particular local conditions are, of course, in many cases more properly classified under other headings, particularly climatic conditions. However, it is necessary in this connection to point out that very local physical features at times exert considerable influence on atmospheric conditions. Protection afforded one orchard by a hill or a large belt of scrub or forest may decidedly affect the incidence of scale insects. The presence of a large area of an alternative host plant, such as often happens in the case of pink wax, may mean that one orchardist may need to adopt control measures different from those chosen by a fairly close neighbour. The influence of purely local factors is often ignored, particularly by small growers, who frequently too readily follow the lead of a neighbour merely because he has clean trees.

The position of trees is also of moment sometimes where the land slopes steeply. Thus trees high up the slope may differ from those lower down, the difference usually being confined to degree of infestation. Positional influence is sometimes bound up with soil factors or exposure to winds, and in such cases the difference may extend to species infesting the trees. The proximity of a windbreak, especially a natural windbreak in which there occurs an alternative host tree, and more particularly the proximity of another orchard, may be of moment.

Of interest, and at times importance too, is the position of the tree relative to a road or other such source of dust. The dust may collect on trees fringing a road, and by interfering with the functioning of the pores in the leaf and other parts become a factor in connection with scale insect incidence. It thus happens, particularly in the Maroochy district, that when an orchard borders a road the outside row of trees may become heavily infested with red scale, whereas this species is extremely rarely found further in the orchard. In the same way, on certain types of soil the lower limbs of trees may harbour larger populations of scale than those higher up, due to the accumulation of dust stirred up during cultivation. This has given rise to the idea that young scale are carried in dust, but this contention is erroneous.

Soil Factors.

From observations carried out over the last two years, it appears very possible that soil exerts some effect on the incidence of scale insects. Some very striking evidence has been collected, but the problem needs much more consideration before anything that is really definite can be given. However, it is of interest to note that in places trees on the same orchard growing on different types of soil carry different species of scales. Care has been taken to check the possible influence of other factors, and the final conclusion reached at times has been that soil variation has exerted considerable and limiting influence. This, of

course, is independent of the effective nutritional value properties of the particular soil—that is, the trees on both types have been in closely similar states of health and vigour.

The nutritional value of the soil is itself a most important factor, but the effect can best be considered in conjunction with plant factors. Apart from fertility, the moisture-holding capacity of a soil is important, and is at times a determining factor.

Plant Factors.

The state of health of a tree often determines the nature of the scale infestation it will carry. Thus an Emperor of Canton mandarin when in normal vigorous condition is very susceptible to infestation by pink wax. On unthrifty trees of this variety, however, pink wax may be of little or no importance, but mussel or red scale will then be commonly found to be present in large numbers. A healthy tree of this variety rarely carries appreciable infestations of either red or mussel except on the fruit under particular circumstances.

In the same way the health of any tree may be a determining factor in the matter of scale incidence—generally speaking, the more vigorous the tree the less scale it will carry. As the health of the tree is governed largely by soil conditions, presence of other pests, and diseases, all of these are of moment in the matter of scale incidence.

As might be expected, varietal susceptibility is also a consideration in this connection. At times, indeed, varietal characters are the determining ones, superseding even climatic influences. For example, it has been mentioned that the Emperor of Canton is very susceptible to pink wax. It will be found that trees of this variety growing in very dry parts where pink wax is ordinarily a rather rare insect may be heavily and habitually infested with this species.

Apart from influences which can be traced to specific causes, very often trees show individual characteristics with respect to scale insects the determining factors of which are not clear. Thus in one block of several hundred trees of one variety a small number scattered indiscriminately throughout the orchard may be persistently more heavily infested than the remainder, which may, in fact, be quite free of the scale. In some cases the trees may be obviously in different condition, a common cause being the bringing up of subsoil during preparation of the land, but in many cases there is no discernible difference between the attacked and free trees. It appears that the cause is to be found in the individual natures of the trees.

Natural Enemies.

The presence or absence of natural enemies of a species can greatly affect the success which it may meet in a particular locality or at a particular time, but as the effective enemies of the scale insects are well distributed throughout the country, it is seldom, if ever, that these natural enemies determine anything more than degree of infestation of a species. The only case in which incidence is likely to be affected is in the event of the arrival of a new species in a locality concurrently with the absence, or presence in overwhelming numbers, of natural enemies. Then, in the first eventuality, the new scale might become established with greater ease than would otherwise have been the case,

and in the second it might fail to gain hold in sufficient numbers to ensure continuation of infestation. As most of the natural enemies attack several species of citrus scales, this latter is possible, but it is nevertheless improbable and would almost certainly be of but a temporary nature. Natural enemies are of consequence in the matter of degree of infestation, and do not determine whether or no permanent infestation will actually occur.

THE ECONOMIC IMPORTANCE OF SCALE INSECTS AS PESTS OF CITRUS IN QUEENSLAND.

As a group the scale insects are the greatest limiting factor in the production of first-quality citrus fruit in Queensland, and that statement could probably be made of almost every country in the world. It is true that in almost every district in this State there is some pest or disease which causes growers more concern, at least over limited periods. Pests such as the bronze bug, *Rhœcocoris sulciventris* Stal., and the larger horned citrus bug, *Biprorulus bibax* Breddin, annually cause larger losses over restricted areas, and other pests such as the sucking moths may destroy larger quantities of fruit during limited periods in various districts, but the scale insects are of importance in practically every district at all times. There are fourteen species of scale insects found on citrus trees in Queensland, and of these all but five are of economic significance. Even with some of the five exceptions it would be unwise to assume that the economic status will always remain as it is now. Of the remaining nine species, seven are responsible for heavy losses in some parts every year, and apart from the status of the group, individual species are frequently the outstanding pests in particular parts. It is, however, as a group that these insects have to be considered. From what is recorded in connection with each species, it will be seen that there is scarcely a time or place that does not favour the development of some species of scale insect. Thus pink wax attacks vigorous trees, particularly in hot periods interrupted by good rains. Pulvinaria attacks vigorous trees, but is more in evidence in periods of rather milder temperatures, particularly in dry seasons. Red scale, on the other hand, thrives on weakened trees, particularly in the hot dry times, whilst should the trees be weak and the season one of high temperatures, together with fair humidity, mussel scale may be expected to make its presence felt. There is scarcely a commercial orchard in the State in which there are not several species of scale insects present, and, generally speaking, every tree harbours two or more. This, together with the breeding-grounds provided by trees outside the orchard in certain cases, ensures a nucleus from which an infestation may arise. Thus in almost any circumstances there is one species of scale which will menace the orchard. The insidious manner of working, together with the rapidity with which colonies increase, assists the species to take advantage quickly of suitable conditions and build up large populations before being detected, or at least before effective control measures can be taken.

Owing to the prolific and rapid reproduction of practically every species, the fight against scale insects is necessarily continuous, and in most of the major citrus-producing areas an orchardist who, by a single application of a scalicide, can keep his trees commercially free of these pests for more than one year is indeed fortunate, and, it may be added,

rare. In the case of at least one species—pink wax—even were elimination of all the individuals in an orchard possible at any one time, this would not ensure freedom from heavy attack for more than seven months at the longest.

That scale insects are so important as pests of citrus is due largely to the frequency with which remedial measures have to be applied, the destructiveness of many species, and the enormous numbers which are commonly present. This last factor is most important, for it means that to be at all efficient a scalicide must obtain a very high percentage kill to establish control lasting a reasonable period.

The status of each species will be considered in a later section in connection with the discussion on the habits of that species.

VERNACULAR AND SCIENTIFIC NAMES.

Naturally it is only by vernacular names that insect pests in general are known to orchardists. Whilst these suffice for most purposes, mistakes sometimes occur through unavoidable variation in these names in different parts of the State, and particularly in different countries. It very commonly happens that journals devoted to farming interests quote extracts on pests from overseas publications, and the rule in these cases is for such articles to refer to insects by vernacular names only. Costly errors have thus resulted in a number of cases, and as the practice is becoming more common, orchardists should be certain that they know exactly what insect is being discussed before making experiments, and the only way of doing this is by reference to the scientific name. Most Queensland citrus scale insects occur in other parts of the world, and many in every major citrus-producing country, and vernacular names not only differ in various countries, but the same or similar names are given to different species in different parts. The black scale of California, for example, is *Saissetia oleæ* (Bern.), which is Queensland's olive scale, whilst Queensland's only common black species, circular black, is *Chrysomphalus ficus* Ashm. In America this species, *C. ficus*, is called the Florida red scale, whilst Queensland's red scale is *Aonidiella aurantii*. The value of vernacular names is therefore obviously limited.

As regards the scientific names, these are unavoidably altered at times, and this may cause growers some confusion, especially when correlating information from books published at different times. Probably the outstanding case is with the old genus *Lecanium*. For many years a large number of the common Queensland scale insects were placed in this genus, and this is one of the few scientific names at all well known to citrus orchardists in this State. The subdivision of the *Lecanium* group into several smaller genera is thus unfortunate in some respects but must be accepted.

For the above reasons a brief account of the various important scientific names has been included, particularly those names which may be found in books readily accessible to orchardists. It may be helpful in this connection to note that in most cases it is only the generic name which has been changed. Thus the red scale has been generally known successively as *Aspidiotus aurantii*, *Chrysomphalus aurantii*, and *Aonidiella aurantii*, the specific name *aurantii* remaining constant.

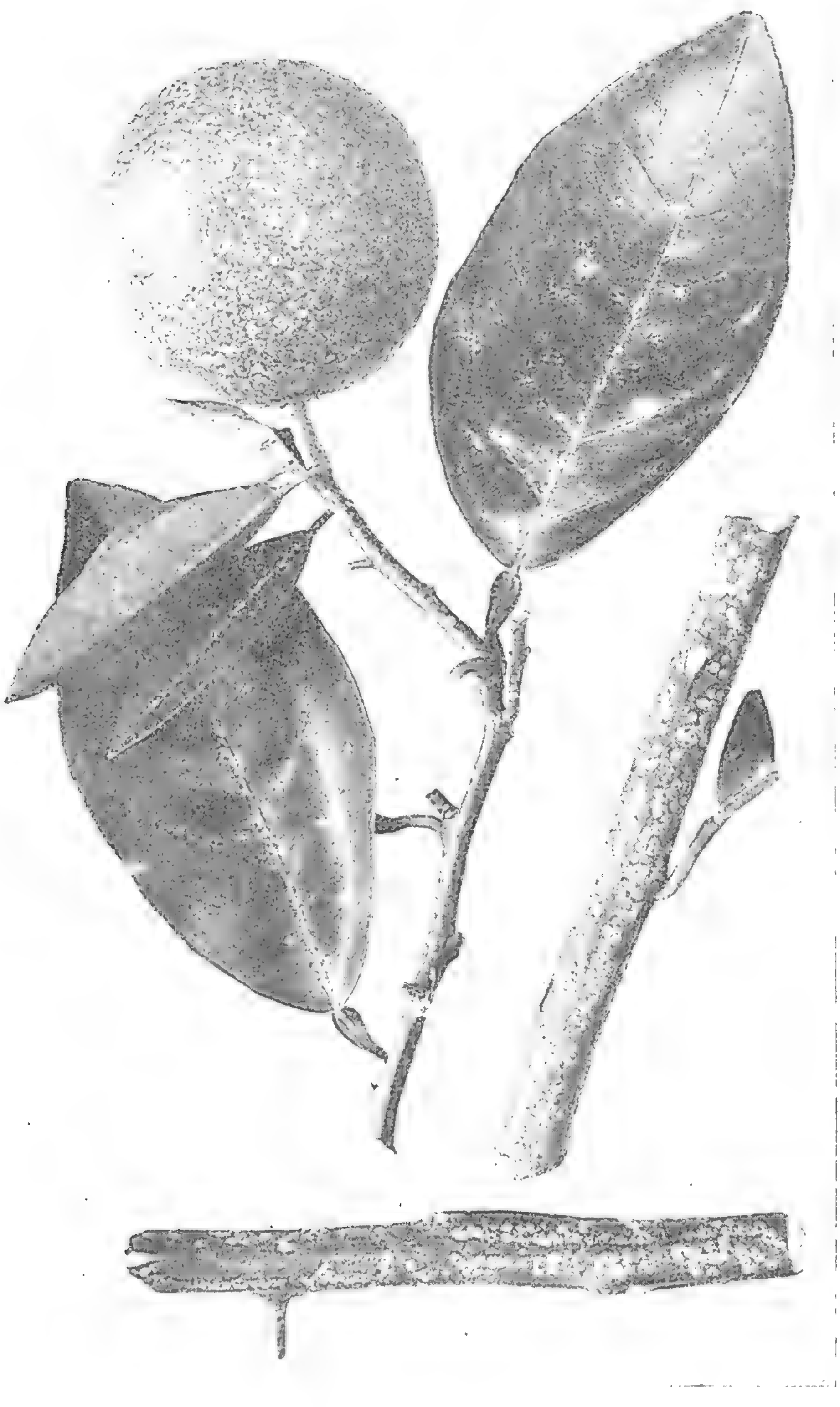

Plate 122.
Red Scale, *Aonidiella aurantii* (Maskell), showing infestation of fruit, foliage, and woody twigs.

RED SCALE.

The red scale, *Aonidiella aurantii* (Maskell), was first described by Maskell in 1878 from specimens taken from Australian citrus fruit imported into New Zealand. Maskell gave the insect the name *Aspidiotus aurantii.* The species was subsequently described under a number of other names, notably *A. coccineus* Gennadius, but the synonomy of these names was fairly quickly recognised. Later it was decided that the insect had been placed in the wrong genus, and experts for the most part were agreed that the correct genus was *Chrysomphalus,* and not *Aspidiotus.* More recently still the name has again been questioned, and from the most recent work it appears fairly certain that the correct naming is *Aonidiella aurantii.*

Description.

The pest (Plate 122) is common and generally well known to orchardists. The main characters by which it can be recognised by growers are as follow:—The scale of the female is circular with flattened margins and with the centre slightly raised. Owing to the fact that the scale itself is semi-transparent, the colour changes of the insect beneath affect the apparent colour, and though the actual colour of the scale is grey, it may appear grey, reddish-brown, or red. The scale is parchment-like in texture.

The young female is somewhat elongate and light yellow in colour, but later the extremity of the abdomen is modified in form, and the insect becomes sub-circular in outline. The colour generally becomes darker as the insect approaches maturity. The diameter of the female scale is approximately one-tenth of an inch.

The scale of the male resembles that of the female in texture and colour, though it is commonly lighter in shade in the case of the former. The male scale is elongate, and the convexity is found towards the anterior end instead of the centre as in the case of the female, the eccentric position being due to the addition of a "flap" at the posterior. In size the scale of a male pupa is scarcely half that of an adult female.

The adult male insect is light yellow in colour, with a conspicuous brownish band running transversally on the thorax. The remaining general characters conform to the description given in an earlier section for typical males.

Distribution and Habits.

The red scale is a notorious enemy of citrus in practically every country which produces that crop. It occurs throughout the tropics and subtropics, having been recorded from the United States of America, Southern Europe, Palestine, Egypt, South Africa, Ceylon, India, Japan, and China, as well as from many smaller countries. The original home of the insect is often given as Australia, but there is doubt on the point, and it is very possible that it is a native of the East.

The list of plants which the insect will attack is a long one, and includes apple, pear, banana, passion fruit, roses, and coconut palms. It is only as a citrus pest, however, that the species is of much moment. Though it attacks a number of indigenous Queensland plants, this is of little importance to citrus-growers, for the colonies in the forest and scrub are never an important source of infestation for citrus groves.

In Queensland the pest reaches its maximum intensity in the drier and hotter parts. In coastal districts south of Rockhampton, where the climate is more humid and the temperatures lower for the greater part of the year, red scale is not so severe a pest as it is in districts within the tropic or interior parts further south.

In every district this scale invariably becomes more important in abnormally dry periods than at other times. In these dry times there is always a very considerable increase in population, and the increase in damage is not due merely to the fact that the trees are then less able to withstand injury. The two factors certainly combine, and in such circumstances red scale commonly assumes the role of a major pest in areas where it is normally of little consequence. The increase in red scale populations in hot dry periods is sometimes attributed to a decline in the efficiency of natural enemies, particularly fungal parasites. All the evidence collected, however, shows that the increase is due mainly to the lower mortality rate of the young during such periods.

The state of the tree as regards health and vigour is also an important factor in determining the extent to which it will be attacked by this pest. Trees with impaired vigour are more susceptible to attack, not only in that they suffer more quickly, but in that they carry larger populations of the pest. The Emperor of Canton variety of mandarin is one which when healthy is rarely attacked to any extent by red scale, the pest in most instances, if present at all, being confined to immature fruit. When, however, it loses much vigour from disease or other cause an infestation of red scale frequently quickly follows. It appears that vigorous trees with a free flow of sap offer marked resistance to the pest, and, further, that on any tree the pest is less liable to become established on free-growing parts than elsewhere, for when trees of supple habit of growth are attacked, it is usual to find the insect confined, at least in the first instance and smaller infestations, to the more woody or weaker parts, where there is no great flush of sap.

Varietal susceptibility is in conformity with what might be expected from the foregoing. Thus lemons, which are more woody, are almost invariably infested, whilst the supple-growing mandarins are usually only troubled when other factors are operating strongly. Even in some very dry parts remote from the coast where the rainfall is very low, and where the available water cannot be used for irrigation, healthy mandarin trees quite free of red scale adjoin lemon trees which are persistently and heavily infested. Also in some of the wetter coastal districts small areas of lemons are sometimes included in an orchard, and though the red scale may be of no significance on the remainder of the trees, artificial control measures have to be applied against the red scale on the lemons. Most varieties of orange may be placed between lemons and mandarins in respect to habit of growth and also to the probability of attack by the red scale, and the placement is roughly quantitative.

The foregoing remarks apply essentially to well-grown trees. With young trees every variety appears to be very susceptible to this pest, particularly trees recently planted out from the nursery.

Red scale will infest all aerial portions of a citrus tree. When the foliage is heavy by far the largest numbers are generally to be found on more exposed parts—leaves, fruit, and twigs. On open and more scraggy trees, however, the limbs and main branches are commonly

found to carry large colonies of the pest, and it appears that red scale prefers positions exposed to sunlight. It is probably mainly on account of this preference that young trees are so frequently attacked, for in such cases little if any of the tree is effectively shaded.

Red scale is a voracious feeder, and no plant can long sustain the depredations of a large colony. Weakening and killing of leaves and twigs is accomplished rapidly, and young worked trees may be killed back to the union of bud and stock within a few months by colonies which could not be considered abnormally large. Even when actual death does not follow, the damage is often such that the tree never properly recovers. A tree which has been stunted during its early life by red scale, as many are, is rarely worth keeping.

On older trees, apart from the damage done directly by the pest, the trees may be so weakened that they are rendered very prone to attack by other insects, such as the borer *Uracanthus cryptophagus* Oll., and particularly by diseases such as melanose, *Phomopsis citri* Fawcett. Melanose is an ever-present menace to weakened trees in Queensland, and it is by the combination of red scale and melanose that a large percentage of older trees in the State are ultimately killed, or at least ruined.

The weakening effect of red scale on trees is overlooked in some instances. It happens frequently that an orchardist finds that some of his trees are heavily infested with red scale, and applies a spray against the pest. A short time later he notices dead wood appearing in the trees, accompanied by a heavy fall of leaves. He may at once condemn the spray material, overlooking the fact that the parts now dead were greatly weakened by the scale, and that almost any spray material would have completed their destruction. In fact, this would not have been long delayed even were no spray used. Whilst spray injury may have similar manifestations, and often does, every year perfectly good spray materials are condemned because orchardists do not take all the circumstances into consideration.

When infesting the fruit, though direct damage is done, in most cases the chief objection growers have to the scale is that the fruit must be cleaned before it is marketed, and the removal of red scale in large numbers is not very easily accomplished. The fruit must be brushed, and the extra handling, besides costing time and labour, always results in some loss of fruit through injury to the rind. The actual loss directly attributable to the brushing and handling may be small, but, particularly in some seasons and certain districts, the entrance of blue and green mould is greatly facilitated. The direct effects of feeding on the fruit are chiefly arrested development and reduction in size.

The female red scale does not lay eggs, but gives birth to living young. On emergence from the body of the mother the young "crawlers" remain for some little time beneath the scale of the parent. On leaving the protection of the scale the "crawlers" settle down in a very short time as a rule. In tests conducted on this point, it was found that under natural conditions "crawlers" at times had become fixed within thirty minutes of emergence from the scale, and that the great majority had settled by the end of eight hours. A few were found to move about for a whole day or more, but these were comparatively rare. The short duration of the period of crawling no doubt explains to a large extent the comparatively slow spread of the red scale from tree to tree. It

has often been observed that one tree may harbour a large population of red scale over a period of years, whilst surrounding trees remain practically free of the pest. Though other factors may operate, the slow spreading of the red scale was certainly the limiting factor in some instances. The scale is no doubt wind-blown to a certain extent, but it appears that this means of dispersion is less efficient with the red scale than with other species which have a longer crawling period.

The scale breeds freely on fruit stored after harvesting—a point which is of interest and importance to lemon-growers in particular, for the "crawlers" will migrate from fruit to fruit and from box to box. As lemons are commonly stored for fairly long periods, care must be taken to include no fruit carrying living scale in a storage lot.

Some writers infer that reproduction commonly takes place without the intervention of the male. Recent work by Nel,[15] however, shows that this is not to be assumed for California, and in so far as Queensland is concerned males are at all times sufficiently numerous to allow of reproduction being normally bisexual.

Life History.

Red scale young are produced practically continuously throughout the year under Queensland conditions. Even in the coldest weeks in winter young may be found, though at that time the number of "crawlers" seen is very small. It has been found that, though mortality in the winter is high, a proportion of the young then produced successfully establish themselves and reach maturity.

In experimental breeding work it was found that the life cycle occupied a period of little less than two months on the average. During January the average falls appreciably, and at this time some females commenced reproduction in as short as forty-eight days after emergence from beneath the mother scale. The life cycle in general, however, may be taken as approximately sixty days. As the young from each female are commonly found to emerge over a period of about fifty days, it would not be expected that any definition of generations would be found in the orchard, and it is difficult at any time during the warmer months of the year to find any suggestion of a dominant stage.

An experiment was conducted with a view to discovering the number of generations which might be expected in a year. In this work the progeny produced in the first six days by twenty selected females were kept under observation. In the same way the first progeny of the next and subsequent broods were used. It was found that with these individuals there occurred five generations in twelve months. This work was done under somewhat artificial conditions—lemon fruits encased in cheese cloth and hung on small trees being used. The artificial conditions may have had some influence on the results obtained, but it is thought that normally there are five broods each year. Observations suggest, however, that at times a partial sixth brood may appear.

CIRCULAR BLACK SCALE.

Early references to the circular black scale, *Chrysomphalus ficus* Ashm., will be found under the name *Aspidiotus ficus*.. Ashmead described the insect as *Chrysomphalus ficus* in 1880, but subsequently the species was erroneously placed in the genus *Aspidiotus*. This error was rectified later, but for some time the specific name *aonidum* was used.

This name was widely accepted, but it appears that Linne's description cannot be definitely referred to this species, and Ashmead's name *Chrysomphalus ficus* therefore stands.

Description.

The scale of the female (Plate 123) is evenly rounded, and has the central portion raised similarly to that of red scale. The colour is purplish black or black with the central point surrounded by a reddish brown or brown band and the margins almost grey. The scale, like that of the red scale, is of parchment-like texture.

The crawlers are light yellow, and on becoming fixed are quickly hidden beneath a white waxy secretion. The well-grown female is rounded in front and tapers sharply towards the posterior end, the shape of the insect thus somewhat resembling that of a pear. The diameter of the female scale is one-twelfth of an inch.

The scale of the male is similar to that of the female, but is elongate and has the raised portion anterior to the centre. The male insect itself is typical of its class, and similar in general respects to the male red scale. The thoracic band of the circular black scale, however, is much darker in colour than in the case of the red scale.

It is characteristic of colonies of the circular black scale that the young settle down in very close proximity to the mother scale in many cases, and scales of many young may overlap that of the old female.

Distribution and Habits.

Circular black scale is widely distributed, and has been recorded from Florida, West Indies, Italy, Egypt, Ceylon, Japan, and Pacific Islands. Though common in many parts, it is not usually regarded as a serious pest of citrus, and is everywhere less feared than its close ally, the red scale.

There are a large number of plants from which this scale is recorded, the list including custard apple, mango, figs, Hibiscus, palms, and a number of indigenous trees. Like red scale, however, its presence on cultivated plants other than citrus does not cause much concern, and the native host plants rarely provide a material source of infestation to Queensland citrus groves.

In so far as citrus is concerned, though the species is distributed throughout the State, it is only in the hotter and drier parts that it can be regarded as a pest of importance. In more humid and milder climates such as at Tamborine Mountain or on the Blackall Range the species is rarely found on tended trees.

Although circular black scale thrives in the hotter localities, colonies as a rule are found in positions which are protected from much direct sunlight. Thus it is usual to find the pest mostly on the shaded side of the tree or on fruit or leaves well protected by overhanging foliage.

The insects do not become established on woodier parts, and are only rarely seen even on the most tender twigs. At all times of the year leaves are infested, but fruit is usually only attacked from the half-grown stage onwards. Even on lemon trees which are carrying a well-forward crop, the young of the generations hatching between winter and midsummer commonly infest only the foliage. It is the young of the third generation which migrate to the fruits—a fact which is of importance in connection with control.

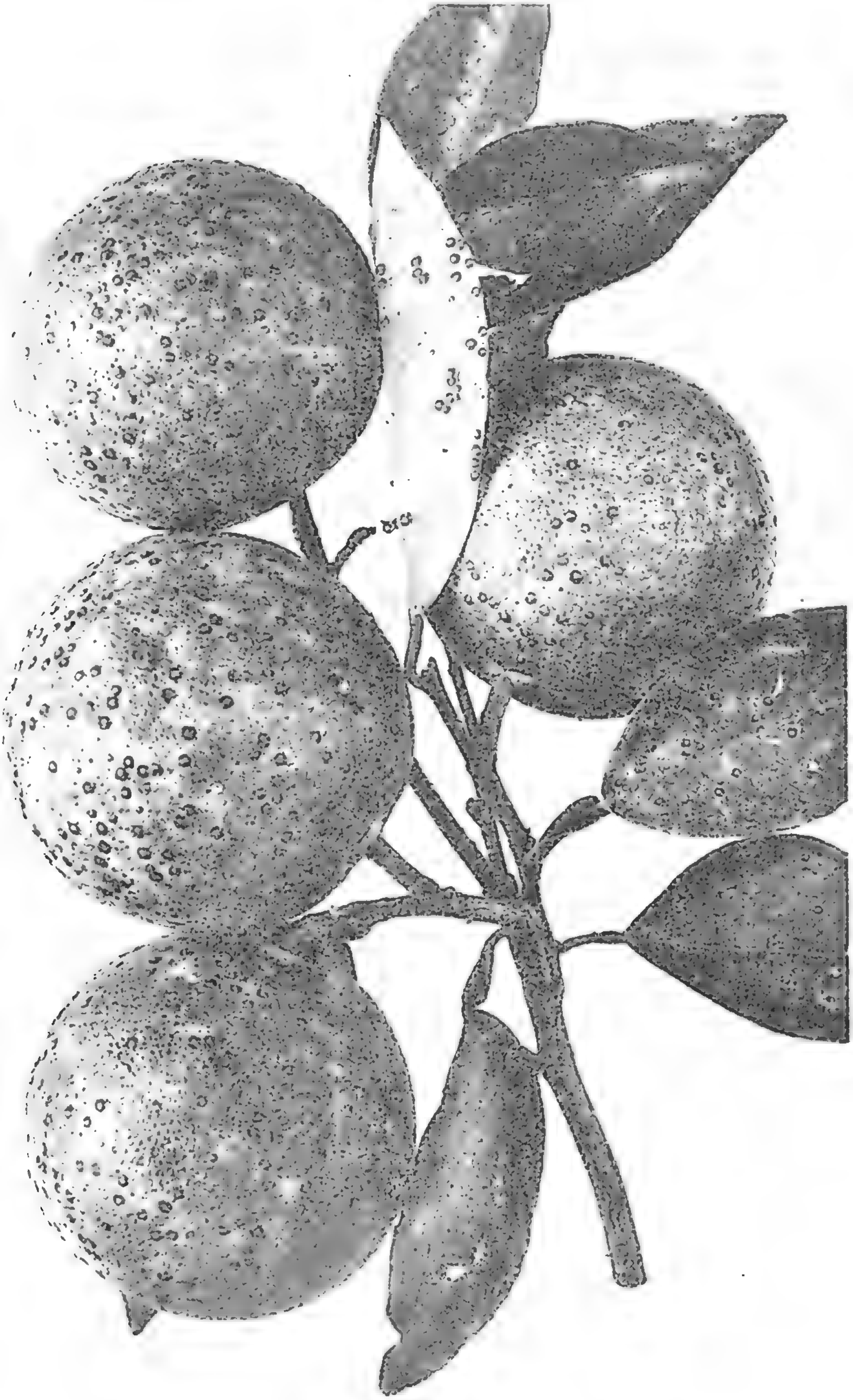

PLATE 123.

Circular Black Scale, *Chrysomphalus ficus* Ashm., showing the normal restriction of infestation to fruit and foliage.

The species cannot be considered a severe pest on the tree, and though marked shedding of the leaves may result, the health of a heavily infested tree does not appear to suffer greatly. The greatest objection to circular black scale as a rule is the disfiguration it causes to the fruit. The scale is particularly conspicuous on a yellow or orange background, and infested fruit must be thoroughly cleansed before being marketed. Apart from the disfiguration, when heavily infested a slight shrivelling of the rind may result, and in some cases retardation of maturation occurs. Younger trees are not often infested to any extent, but older trees of all varieties are attacked. More trouble is experienced by lemon-growers than others, but any variety of fruit which matures after mid-season may favour the development. For this reason mandarins are seldom attacked to any great extent, whilst oranges of late-maturing varieties, such as the Valencia Late, sometimes carry heavy populations of this pest. In particularly dry seasons, however, even the earliest maturing varieties of mandarins may need to be treated for an infestation.

Males of circular black scale are comparatively rare, and it appears that reproduction is normally parthenogenetic—that is, occurring without the intervention of the male. If such a mode of reproduction be normal, when both sexes combine the progeny are sometimes found to be of one sex only. This may account for the fact that at times colonies of circular black are found in which the males greatly predominate.

The adult females produce eggs which hatch very shortly after exclusion, giving rise to the minute, yellow crawlers, which may remain for two days or more beneath the scale of the mother insect. The free crawling stage is of short duration, sometimes not more than a few hours, and the young in many cases does not move any distance away from the site of hatching to settle down to feed. It is not uncommon to find as many as six young settled beneath the scale of the mother insect, and it would appear that this is due in part to the young experiencing difficulty in escaping. This multiple settling under old scales is most noticeable on the fruit, and in tests of scalicides it was found that in every instance where sprays were employed the kill on the fruit was considerably lower than on the leaves. It appears that on the fruit, particularly at times when eggs are being laid, the adult female keeps very firm contact with the surface. This habit of becoming fixed in close proximity to the old insect at times acts to the detriment of the pest, for leaves injured by the insect and shed prematurely may carry large numbers of quite young scales, which are thus removed from the tree with very little, if any, possibility of returning. Migration from tree to tree is much more pronounced with this species than with the red scale, though the spread through an orchard is still very slow.

Life History.

The winter is passed in immature stages, and the first young following this season are to be found about the beginning of September. Though from this time throughout the warmer months young are constantly produced, overlapping of generations does not occur to a very great extent, and while representatives of all ages may be present on any tree, it is usual to find that the great majority of individuals are of approximately the same age, except towards the end of summer, when, as would be expected, overlapping is more pronounced.

The brood produced in September reaches maturity toward the end of the following month or early in November, and a second generation is at once commenced. The development of this second brood occupies November and December, and at about the end of the year—or more typically, early in the new year—a third generation makes its appearance. This third brood infests the trees from January to about the beginning of March, and, as has been mentioned above, it is the young of this brood that first migrate to the fruit. Early in March the fourth generation begins to emerge. The emergence of young of this fourth brood continues over a much longer period than in the case of any other, and consequently there is a greater diversity of stages then than at any previous period. The fourth generation is composed of those individuals which persist through the winter and reproduce again in the following September. The prolonged period of hatching is due to the variation in developmental periods in different individuals of previous generations more than to the fact that the period of fecundity of the females may be prolonged at that time of the year. Owing to the variation in size and evident age of the insects during the winter, the idea is sometimes held that a fifth main hatching takes place during the cold months. This impression is strengthened by the fact that even in the coldest times young crawlers may be found beneath old scales. However, close observation was kept on several hundred females known to be of the fourth generation which hatched at the average time, and these did not reproduce until September. As regards the young which are sometimes found in the winter, these are few in number, and, further, from tests conducted it appears very unlikely that any appreciable proportion of them survives the cold weather. In tests carried out at Nambour the mortality of young emerging between the second week in June and the beginning of August was almost 100 per cent. The effective, and in all probability the actual, number of generations per year then is four.

In the experimental breeding work during the past three years the actual time required for the development of females from emergence from beneath the scale of the mother to the production of young was found to be remarkably constant during the warmer months, the variation for by far the greatest number of insects being but two days—viz., sixty-four to sixty-six days. Small numbers may take either a little less or a little more time, and the shortest period taken was fifty-eight days during February and March, 1931.

MUSSEL SCALE.

For some time mussel scale, *Lepidosaphes beckii* (Newm.), was known as *Aspidiotus citricola,* the name under which it was described by Packard in 1870. A few years later it was transferred to the genus *Mytilaspis,* as defined by Signoret, and it was under that generic name that much of what has been written of the scale in Australia appeared. Later work, however, elucidated the fact that Newman had described the species a year earlier than Packard, and therefore Newman's specific name *beckii* precedes *citricola.* The correct genus has also been found to be neither *Aspidiotus* nor *Mytilaspis* but *Lepidosaphes.* As most of the older Australian books give the name as *Mytilaspis citricola,* the change to *Lepidosaphes beckii* may be confusing.

Description.

The scale (Plate 124) of the female is purple, or in older specimens almost a drab brown. The surface is somewhat roughened. The cast skins or pellicles are conspicuous at the anterior end as a lighter area, though in very old specimens these may be a dark brown instead of reddish, as they more normally are. The margins of the scale are whitish. The scale is elongate, slender, and somewhat mussel-shaped, the sides curved, and the whole convex. The texture is similar to that of the red scale, but in the case of mussel scale is thicker and more leathery.

The adult female is creamy white with the last segment of the abdomen reddish. The body is considerably broadened at the posterior end, and the segmentation of the abdomen is well defined. Beneath is a ventral scale which is entire over the body of the insect. This scale is white and is very easily ruptured. The eggs are laid in irregular formation, and as each egg is produced the female shrinks up towards the anterior, so that finally almost the whole of the space under the scale is filled with the eggs. The length of the female scale is one-tenth to one-eighth of an inch.

The scale of the male is similar in general respects to that of the female, but is smaller, less curved, and rather lighter in colour. The adult male is of the typical winged form.

Many growers style *L. beckii* Glover scale, but though the species are similar they are distinct. Glover scale is very closely allied, but is *L. gloveri* Packard. This species differs from *L. beckii* in that the ventral scale of the former is divided and the eggs, instead of being irregularly arranged, are set in two parallel rows. The female scale of Glover scale is narrower than mussel, and also has the sides straighter. W. W. Froggatt records Glover scale from Victoria and New South Wales, and H. Tryon[16] has recorded it from Queensland on citrus. There are a few dried specimens in the departmental collection labelled Glover scale as from citrus in Queensland. Definite identification of these specimens cannot now be undertaken, however. During the course of this investigation no Glover scale has been found on citrus in Queensland, and if the species attacks citrus in this State it must be very rare. It is probable then that when growers are under the impression that their trees are infested with Glover scale the species is actually mussel.

Distribution and Habits.

Green[1] states that mussel scale is found almost wherever any species of citrus is cultivated. It is common throughout the citrus districts of this State, and though it has been recorded from a number of indigenous hosts, these do not constitute breeding-grounds capable of providing appreciable infestations to citrus orchards. In Queensland the mussel scale is primarily a pest of the coastal parts, and it appears that the low humidities commonly experienced in more inland regions act to the detriment of the pest. In coastal areas the mussel scale is comparable to the red scale in interior parts as a pest of citrus. The damage to the trees is severe and follows rapidly on the occurrence of large populations. Fruit, leaves, twigs, and branches up to an inch in diameter or even larger are attacked. The fruit is usually not attacked until it is fairly well developed, and though a few individuals may be found on them in early January, it is usually not until about the beginning of March that appreciable numbers occur there. On the fruit

PLATE 124.

Mussel Scale, *Lepidosaphes beckii* (Newn.), showing infestation of woody parts and resultant death of twigs.

the most favoured sites for feeding are at the stem end against the "button," or, if the fruit be clustered, around the points of contact of the two fruit (Plate 125). Later the colonies extend to any part of the fruit, and dehydration of the rind commonly ensues. If the infestation at the stem end be at all heavy premature yellowing and dropping may result. As well as the direct injury caused by feeding, mussel scale is most objectionable on the fruit, as it is disfiguring and is most difficult to remove by brushing. This scale is a much more difficult one to remove than the red or the circular black scales. Healthy tender twigs are not often attacked, but more woody twigs or those of harsh growth support the largest colonies. Small twigs which support the pest quickly lose vigour, and the scale gradually works its way back along these weakened parts. Such twigs are usually quickly killed by the scale alone, but larger parts generally survive long enough to become infested with melanose or some other such malady, and death is finally brought about by the combination of the scale and that disease. Melanose is very commonly associated with this scale in the more humid parts of the State. Young leaves do not usually harbour the pest, but older leaves, particularly those inside the tree which are protected to some extent, are prone to attack.

It is characteristic of the young to settle down shortly after emergence, and commonly they do not migrate any further from the mother scale than is necessary to find a clear portion of the plant surface. Thus colonies are typically so closely crowded that the scales of all individuals touch or overlap each other, even though there be an abundance of suitable feeding sites within a radius of less than an inch. On woody parts the colonies may be so dense as to form an incrustation completely covering the bark. Such an incrustation may extend from the limit of hardened growth or living tissue back a foot or eighteen inches along the branch. The species does not spread very quickly through an orchard under ordinary conditions, and one or a few trees may carry large colonies for a considerable time before appreciable numbers are found on neighbouring trees. However, when suitable conditions prevail on any tree an infestation quickly follows.

All commercially-grown varieties of citrus are susceptible, but mandarins usually carry more individuals than comparable oranges. Lemons are infested heavily at times, but are seemingly much less attractive than mandarins or oranges. On healthy trees mussel scale in appreciable numbers is usually confined to the immature fruits. The species is, however, essentially a pest of weakened trees. Mussel scale is second only to red scale in importance as a citrus scale pest in Queensland, and as will be seen by comparison, the two species have much in common, the one predominating in coastal parts and the other in the interior.

Life History.

In experimental breeding work it was found that during the warmer months of the year females may produce eggs within about sixty days after emergence. The great majority of individuals, however, require about sixty-five to sixty-seven days in which to complete the life cycle. Eggs are produced throughout the year, and with no other species found on citrus is effective winter reproduction so pronounced. Even in the coldest times the crawlers are able to become established and natural mortality in the winter is not at all high.

Plate 125.

Mussel Scale, *Lepidosaphes beckii* (Newn.), showing infestation of fruits at point of contact and at stem ends.

A month may elapse between the times of hatching of the first and the last egg produced by one female, and thus there is no defined succession of generations. At only one period of the year is any suggestion of a pure brood to be observed. This occurs at times during February, and at this time colonies are frequently found in which almost every individual is of approximately the same age—adult females just ready to lay or laying. From this it would appear possible that the typical hot dry January weather is responsible for a high mortality of young. It is probably on account of this also that the insect is relatively unimportant in interior districts.

From the period occupied in completing the life cycle it appears probable that there are four generations each year.

WHITE LOUSE.

When first examined, White Louse, *Chionaspis citri* Comstock, was not recognised as a distinct species, but was included by Comstock in the species *Chionaspis euonymi*. Comstock, however, observed certain differences, and in 1883 he described this insect as a separate species, and gave it the name of *Chionaspis citri*.

Description.

The scale of the female (Plate 121, fig. 2) is a dull brown or almost black colour, with grey margins, and with the brown or yellowish pellicles rather prominent at the anterior end. The shape is somewhat similar to that of the mussel scale, but the curving of the sides is much less pronounced or may be quite absent, and instead of being regularly convex, along the central line there is a ridge from which the sides slope away to the margins. The scale, which appears comparatively thick, is parchment-like in texture, and is commonly covered with minute particles of dust which adhere readily to it. The adult female (Plate 121, fig. 3) is creamy coloured, elongate in outline, and has the abdomen rather deeply segmented. The scale of the male (Plate 121, fig. 4) is white and carries three distinct longitudinal ridges along practically its whole length. The pellicles, when fresh, are yellowish, but later turn brown and are not readily seen unless the insect be removed from the plant. The adult male (Plate 121, fig. 6) has a light-yellowish body, and is normal in general form. The crawlers are elongate, yellowish in colour, and rather more robust-looking than in most other species. The length of the female scale is one-sixteenth of an inch, and of the male scale one-twenty-fifth of an inch.

Distribution and Habits.

White louse was originally obtained on orange trees in Louisiana and Cuba, and it is considered probable that it was imported into New Zealand and Australia from America. In Queensland the species is common in all parts where citrus is grown, and citrus appears to be the only host plant which has been recorded, either in Australia or elsewhere.

White louse differs from all other citrus scales in Queensland in that the males are much more in evidence than the females, and growers are very seldom familiar with the latter sex of this species. The young seek depressions in the bark in which to settle, and the females adhere very closely to the host plant. As they are commonly covered with dust

and other foreign matter and their colour harmonises with that of unhealthy bark, it is often rather difficult to find the females. The males are not only more conspicuous in themselves but are always abundant, the males commonly many times outnumbering the females. A heavily-infested tree may appear from a little distance to have been whitewashed, but even the closest examination of such a tree without a hand lens will possibly not disclose the whereabouts of a single female. That the vernacular name should be derived from the appearance of the male is therefore not surprising though rather extraordinary.

The white louse thrives in many different climates, and temperature does not appear to exert any marked effect on the degree of intensity of infestation. Humidity, however, does seem to be of importance, and in any district the pest is much more in evidence in dry than in wet times.

All aerial parts of the tree are affected, but the white louse is essentially a pest of the trunk and main limbs. Infestation usually commences on the trunk a foot or two from the ground and spreads upwards. On the trunk and main branches, attacked bark becomes hard and dark in colour, and the tree presents a hidebound appearance. Vigorous trees carrying large colonies usually show a cracking of infested bark. These cracks may serve as a point of entrance for the borers *Symphyletes sodalis* Pasc. and *Uracanthus cryptophagus* Oll., or other detrimental organisms. Gumming commonly results when the bark splits, particularly if this happens low down on the tree.

Fruit, leaves, and twigs are also susceptible to attack, but white louse is seldom found on these parts of tended trees. The extent to which the scale will disperse through the tree is governed to a very large extent by the general health of the tree, the less vigorous the tree the further the scale penetrates from the trunk. Leaves and twigs may be badly damaged, but white louse does not bring about the death of these parts with anything like the rapidity of red or mussel scales. Whilst the fruit is rendered unsightly by the presence of the scale, this is rarely of importance, as, if an appreciable proportion of the fruit carry the insect the trees are so unthrifty that the total crop will certainly be small.

All varieties of citrus are attacked, but mandarins as a rule do not harbour nearly as many individuals as comparable lemon or orange trees. Young trees are seldom attacked to any extent. That the scale is not of greater importance is due mainly to the fact that it is fairly easily controlled. The conspicuous males ensure that attention will be drawn to colonies before these become very large. The damage to the trunk, however, is often such that orchardists must regard this species as potentially a very bad pest. The small amount of damage done at times by very large colonies is no doubt due to the fact that the females may form but a very small portion of the population.

Life History.

Under orchard conditions in Queensland white louse breeds practically continuously throughout the year. Young may always be found, though the number present in the winter is small, and mortality at that time high. In experimental breeding work females required on the average about sixty-five days in which to complete their development. As young may be produced by any one female over a period of from three to six weeks, there is no clearly defined succession of generations. A fairly large hatch is noticeable early in September, but apart from

this, under field conditions the seasonal life history is featureless, and little assistance in the matter of control is to be gained by a detailed knowledge of it. From experimental breeding work in which selected individuals of each brood were used, five generations were secured in twelve months, and from this and field observations it appears that there are ordinarily five generations, four of which are large and the fifth (that occurring in the autumn and winter months) small.

HEMISPHERICAL SCALE.

The hemispherical scale, *Saissetia hemispherica* (Targ.), was first described by Targioni-Tozetti in 1867. Originally it was placed in the genus *Lecanium*, and under that generic name it became widely known both to entomologists and agriculturists. The old genus *Lecanium* has now been divided into several smaller genera, and the hemispherical scale has been placed in that section now known as the genus *Saissetia*.

Description.

The species (Plate 126, fig. 6) is easily distinguished from the other citrus scale insects. The recently-hatched young are very pale-yellow and active, possessing well developed legs and antennæ. When first settled, the young females are only very slightly convex, but gradually become more so until finally, by the time maturity is reached, the shape is almost hemispherical with narrow flattened margins. The recently-settled young are light brown, and as development proceeds the dorsal or upper surface darkens and ultimately is shining brown or reddish brown. In immature stages three ridges on the dorsal surface intersect to form an elevated "H," but later this marking disappears, and in full-grown specimens the surface is quite smooth. This "H" varies in prominence—in some individuals it is very distinct, whilst in others it is scarcely discernible. Seen under a hand lens the dorsal surface has a marbled appearance, due to the fact that the thickening of the derm is not uniform. The female insect does not secrete a scale, but remains naked throughout life. The thickened dorsal derm, however, somewhat resembles a true scale in appearance.

On completion of egg-laying the mother insect dies and quickly dries out, and the body is drawn up against the dorsal derm. On removal from the plant it is found that the insect has become merely a hollow hemispherical-shaped shell, beneath which is a space loosely filled with a mass of minute, white eggs. The female scale is very variable in size, the average length being about one-tenth of an inch.

The male insect is at first naked and cannot be distinguished from the female. After the second moult, however, the males secrete a true scale which is transparent and of glassy appearance. The male hemispherical scale is rarely found in Queensland.

Distribution and Habits.

The insect is very widely distributed, and has been recorded from practically every civilised country. Throughout the tropics, it is common on a very large number of plants under natural conditions, and in temperate and colder parts it becomes a pest in greenhouses. The list of host plants is long and comprehensive, including as it does species from

many families of plants. Coffee, custard apple, crotons, gardenia, chrysanthemums, and several kinds of fern are some of the cultivated plants which the insect will attack.

Hemispherical scale is to be found in every major citrus-producing district in the State, but it is seldom that it becomes a pest of any importance. It reaches its maximum intensity in coastal parts, and the heaviest infestations occur on the Blackall Range, but even there it is confined in large populations to but a few orchards at any one time, and then only a small proportion of the trees are affected in the great majority of cases.

In settling down the young usually choose the very young soft twigs, and the insects are very rarely found on growth that is at all hardened. After settling down to feed the insects do not move again until the time of reproduction approaches. Then the females may migrate from the twigs to the leaves, or less often to the fruits. When small colonies only are on a tree the presence of an infestation may remain unobserved during the larval period, for the very young make use of any depression, and later the colour harmonises well with that of the twigs. However, the habit of the adult females of migrating may disclose their presence at about the time of reproduction, for they are then larger and take up exposed positions.

Large colonies of the insect may be accompanied by a growth of sooty mould, but the presence of this fungus is not a characteristic of the species, and very large colonies may be quite free of any such growth.

All varieties of commercial citrus are attacked, and though lemons are seldom found to carry an appreciable number of the pest, this is probably due to factors other than varietal ones. Beauty of Glen Retreat mandarins appear to be rather more favoured than any other commonly grown variety. Irrespective of variety the largest populations occur on trees two to four years old, which carry abundant foliage and much tender growth. Even on these trees the amount of injury sustained is rarely of any moment, and only exceedingly heavy infestations need cause concern. The species is, then, of little economic importance, though there are occasions when it becomes necessary to apply artificial measures against the pest.

Life History.

The hemispherical scale completes its life cycle rather more quickly than do most other species of citrus scales. The period elapsing between egg-hatching and production of eggs for the following generation varies in most individuals from forty-eight to fifty-six days during the warmer months. The insects over-winter in immature stages. Maturity is reached during September by most of the over-wintering females, and there is usually a large hatch of eggs during the second fortnight of that month. Following this, other main hatches occur as a rule in early November, late December, in February, and again in March or early April. There are thus five main broods each year. However, at almost any time other than towards the middle of winter, eggs, and therefore after November, all stages, of the insect may be found. The main broods are, however, usually well defined, and when a large colony is found the great majority of the individuals are in the same stage of development, and this stage will generally be found to be that which would be expected from the times given above in connection with main hatchings. This

is so because the rate of development of individuals from any one batch of eggs is fairly uniform. Large populations are built up only in abnormal circumstances, which circumstances are naturally quite temporary, and unless the effect is felt by the large majority of individuals in the colony, it will not be far reaching. The hemispherical scale is kept in check to a very large extent by natural enemies, and the abnormal circumstance is usually the failure of an effective parasite. In the case of small colonies the individuals are usually in the same stage of development, though they may differ greatly from the average for the species.

OLIVE SCALE.

The olive scale, *Saissetia oleæ* (Bern.), was first described by Bernard in 1782 under the name of *Chermes oleæ*. From time to time since then it has been placed in several genera, but the only other name under which much has been written of the species is *Lecanium oleæ*. As has been mentioned above in connection with the hemispherical scale, the genus *Lecanium* has been redefined, and this species is now in consequence known as *Saissetia oleæ*.

Description.

There has been a great deal of confusion in Queensland in connection with this scale (Plate 126, fig. 5), and orchardists and others commonly refer to the hemispherical scale as the olive scale. Though the two species are closely allied, there is not much similarity in general appearance, and it is difficult to account for the error. The description of this species should be checked against that for the hemispherical scale in any case of field identification.

The adult female is brownish-black, or under Queensland conditions almost quite black, with a little speckling of white. The outline is roughly oval and the margins are irregular. The surface is roughened, and there is a persistent and prominent "H" marking on the dorsal surface. It will be noted that in the hemispherical scale this "H" marking disappears before maturity, whilst in the olive scale it is present in the adult females. The female is strongly convex, but does not present the regular hemispherical shape typical of its ally, *S. hemispherica*. The length of the female scale is about one-seventh of an inch. The male has not been found in Queensland.

Distribution and Habits.

Olive scale is widely distributed throughout the world, having been recorded from Europe, South Africa, Ceylon, the United States of America, and other smaller countries. It appears, however, to be of more importance in temperate than in tropical countries. In the course of recent investigations the species has been found in the south-eastern portion only of Queensland. It may, of course, occur in other parts of the State on other plants, or citrus in small centres of production, but if so it would appear to be uncommon on them. The scale attacks numerous plants, both cultivated and wild, but it is eldom a pest of importance on any host. The best-known host plants are olive, rose, figs, guava, and some species of deciduous fruit trees. In so far as citrus in Queensland is concerned, the species is of no importance whatever. In the course of the last five years only about thirty small colonies have been found

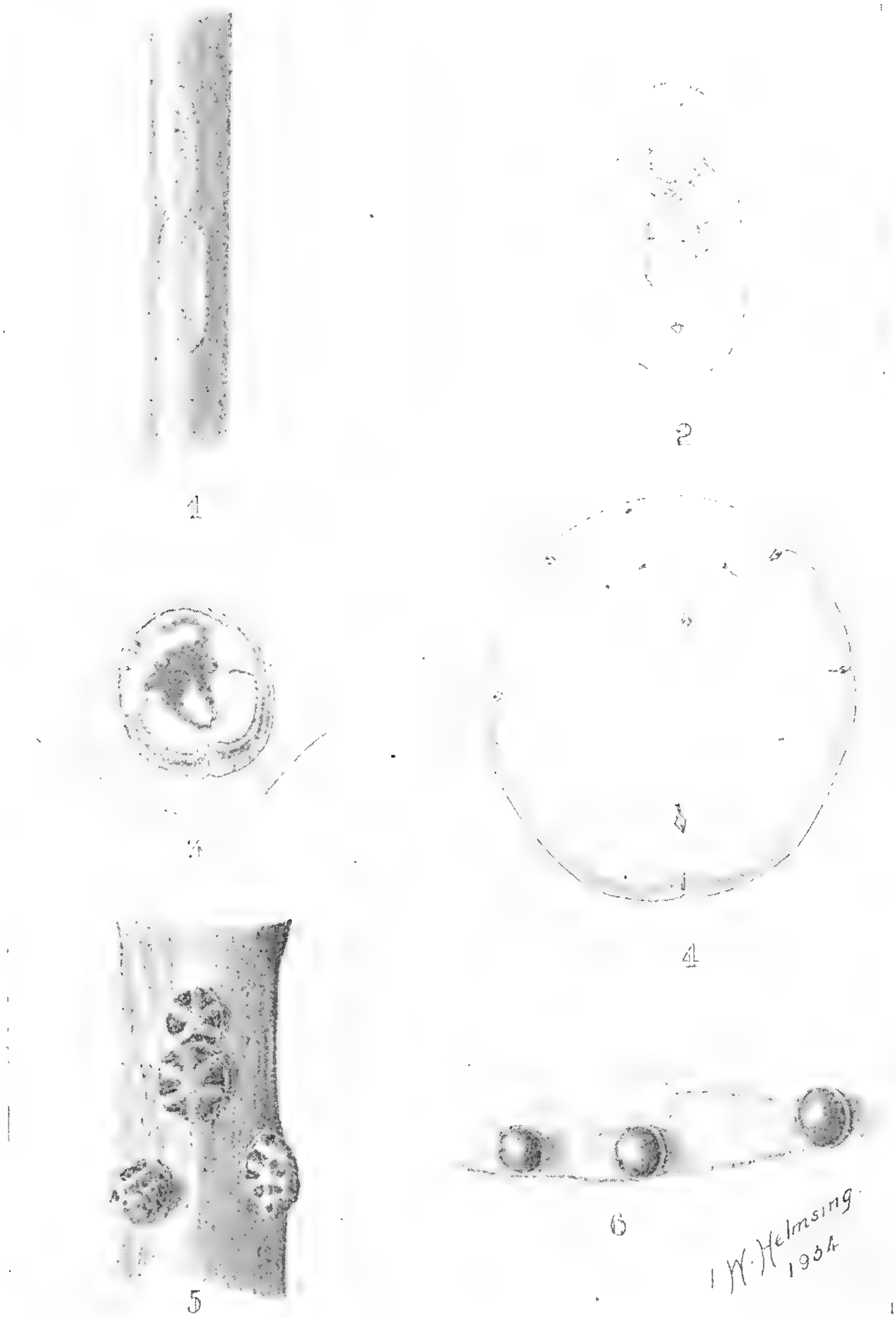

PLATE 126.

Fig. 1, Long Soft Scale, *Coccus longulus* (Douglas), on stem × 3. Fig. 2, Microscope mount of Long Soft Scale × 8. Fig. 3, Flat Scale, *Paralecanium expansum* (Green), on leaf × 3. Fig. 4, Microscope mount of Flat Scale × 8. Fig. 5, Olive Scale, *Saissetia oleæ* (Bern.) × 3. Fig. 6, Hemispherical Scale, *Saissetia hemisphærica* (Targ.) on leaf × 3.

on citrus in this State. Under these circumstances very little work has been done on the pest. Attempts were made to establish colonies on laboratory trees without success. From accounts given by Quayle (5), Woglum (6), and others, of the pest in the United States, it appears that in California this species rivals red scale in importance as a pest of citrus. This is due, no doubt, in part to the fact that in certain areas in that country *Saissetia oleæ* is resistant to cyanide. A sooty mould fungus accompanies colonies of the pest, and this adds to the injury suffered by citrus-growers affected by this species. Quayle states that high summer temperatures limit the distribution of the species in California, and this may be largely the cause of the unimportance of the insect in Queensland. From the limited observations possible in this State it appears that, though the insect is to be found on succulent parts, it will attack parts much more woody than the hemispherical scale.

Life History.

As has been mentioned, in view of the status of the species in this State, very little work has been done on this insect and the life history under Queensland conditions is not known. Quayle states that normally in most districts in California there is but one brood each year, the main egg-laying period being in mid-summer (corresponding to November, December, and January in Queensland). The same writer states that irregular hatchings occur in his country, and from field observations on a very limited number of specimens it would appear that irregular hatchings are a feature of the life history in this State also, if there be but one brood per year here.

SOFT BROWN SCALE.

The soft brown scale, *Coccus hesperidum* (Linn.), has been known for a very long time, having been described by Linnæus in 1735. Since that time it has been given more than a dozen names, but *Lecanium hesperidum* is the only one of these of much interest. It is under this generic name that the species is most widely known in Queensland, but this no longer stands, and the insect is correctly called *Coccus hesperidum*.

The minute crawlers are pale-green or yellowish-green, and are elongate oval in shape. They do not as a rule migrate far from the site at which they were produced, and thus colonies may persist in one small portion of a tree for a long period without the infestation spreading to other parts of the tree. The immature settled females are flat, naked, and rather yellowish in colour. The adult females are somewhat convex, and are roughly oval in shape, though rather longer than broad. The colour varies from yellowish-green to very dark-brown. Under a hand lens the dorsal surface is seen to be marked with numerous brown dots, which at times may form ill-defined and somewhat wavy lines. In all but the darkest specimens the eyes are conspicuous as brown or black points situated close to the margins at the anterior end. The scale is very commonly parasitised in Queensland, and the presence of internal parasites in the body may affect the colour of the scale insect. Thus a colony rarely presents a uniform appearance as regards colouration. The length of the female is one-eighth of an inch.

Distribution and Habits.

The soft brown scale is widely distributed throughout the world, having been recorded from Europe, North and South Africa, Japan, Ceylon, North America, Brazil, and other countries. In Queensland the species appears to be confined to the southern portions of the State remote from the tropic. The insect has been recorded as attacking many plants both cultivated and wild in other countries. W. W. Froggatt[12] states that it occurs on many cultivated plants, and even native shrubs in Australia. In the course of this investigation it has been taken on only one indigenous plant—namely, river cherry (*Eugenia* sp.). A few individual scales closely resembling *C. hesperidum* were found on *Hibiscus heterophyllus* Vent., but the specimens, all of which were parasitised, were not suitable for definite identification. At all events the question of native hosts has no bearing on the control of the scale on citrus.

The scale is a very rare one in citrus orchards in this State, and though on occasions isolated large colonies may be found, these are very soon attacked by natural enemies, and never persist longer than one generation. Soft brown scale feeds only on the most tender parts of the tree, and mandarins appear to be more favourable to the insect than other varieties. Even the heaviest infestations so far encountered in this State, however, have been cases in which a few twigs on but one or two trees in an orchard were affected, and the scale is of little consequence from an economic point of view. Under present conditions growers need not be concerned about it as a pest of citrus.

Life History.

Under the circumstances little work has been done on the life history of the species. Colonies were established under experimental conditions for observations, but the percentage parasitism of these colonies was always so high that very few individuals could be used in this work. The time taken for the completion of the life cycle by those females which escaped parasitisation varied from sixty-one to sixty-seven days during the warmer months. From this and other observations it seems that there are normally four generations per year. The late summer generation appears to be the largest, but from February onwards the parasites are particularly numerous, and any great increase in population is thus unlikely even at that period of the year. From the very limited field observations it appears that generations are fairly well defined, and that no considerable irregular hatchings take place.

LONG SOFT SCALE.

Long soft scale, *Coccus longulus* (Douglas), was originally described by Douglas in 1887 and given the name *Lecanium longulum*. It was known under this name for many years, but when the division of the genus *Lecanium* was brought about this species became part of the genus *Coccus*.

Description.

The crawlers are elongate, light-coloured creatures which move very quickly about the plant before settling down to feed. The female (Plate 126, fig. 1) does not secrete a scale, and though the dorsal derm is thickened the insects are quite soft until reproduction commences when

the derm appears rather scale-like, and tougher, but even then it is by no means hard. The general colour is light-brown, or at times somewhat yellowish, with the margins darker than the remainder. The eyes can be observed as dark spots situated towards the anterior end and near the margins. The scale is convex and presents the appearance of a half-cylinder with the edges flattened. Newstead[7] records that some specimens resemble very much the soft brown scale (*C. hesperidum*), but this has not been observed in Queensland specimens, and the scale can be easily distinguished from all other citrus scales in this State by its light colour in conjunction with its long narrow shape. The male of the species has not been observed in Queensland. The length of the female is one-fifth of an inch.

Distribution and Habits.

The long soft scale has been recorded from England (on exotic plants), Massachusetts (U.S.A.), Pacific Islands, Ceylon, and other parts. In Queensland it is rarely found on citrus except in tropical districts, where at times it becomes plentiful. The heaviest infestations so far observed were at Yeppoon and Bouldercombe, in the Rockhampton area, whilst appreciable numbers may at times be found on isolated trees at Gayndah. Apart from citrus, the only plant on which the scale has been found in the course of these investigations was custard apple. Several other host plants have been listed in other countries, and though the scale possibly infests these or allied trees in Queensland, the existence of alternative hosts is of little importance to local citrus-growers. It is of interest to note that the long soft scale may frequently be found on custard apples in regions much further south than those in which only an odd individual has been seen on citrus, even though this latter host be growing in the same locality. Dry seasons appear to favour the insect.

The young settle down on tender twigs, and the remainder of the life of the female is spent there for the most part. However, reproducing adults may be found on the leaves always close to the midrib, and it appears that such individuals migrate to the leaves just before reproduction is commenced. The presence of a colony is usually denoted by a copious growth of sooty mould, and in all cases noted the presence of this fungus has been the most objectionable feature of the infestation. The insect itself apparently does not affect the tree to any marked extent, and the amount of injury following even quite heavy infestations is slight.

Mandarins are the only trees on which any large colonies have been found, and it appears that the Emperor of Canton variety is the most preferred of those commonly found in Queensland orchards. As will be mentioned later, the pink wax scale also commonly infests this variety of tree, and it is of interest to note that in no case have both of these species been found in appreciable numbers on the one tree. In quite a number of places where pink wax has been found thickly infesting surrounding trees, those carrying the long soft species were either almost or quite free of the former species.

Life History.

All attempts to establish colonies of the long soft scale on experimental trees at Nambour have failed. The failure may have been due in part to unsuitable climatic conditions, but possibly the same factor which influences the incidence of the species on certain trees as outlined above

was also operating. The information on the life history, then, is confined to what has been obtained from field observations. The broods appear to be distinct, and reproducing females have been found in November, late January, and late March. From this it would appear that a fourth hatching might occur in or about September. This, however, has not actually been observed. It is considered very probable, however, that the insect completes four generations each year.

FLAT SCALE.

The flat scale, *Paralecanium expansum,* was described by Green in 1896 as *Lecanium expansum,* the generic name becoming *Paralecanium* when the division of the larger genus took place.

Description.

The scale (Plate 126, fig. 3) is quite different in appearance from all other species occurring on citrus in this State, and there is no likelihood of any confusion in identification. The immature females are so flat as to appear as merely a single thickened tissue on the surface of the leaf, and even the adults at the time of reproduction are only very slightly convex. The adult female is almost circular in outline, but is slightly longer than broad and somewhat tapering to the anterior end. The regularity of outline is broken by two indentations on each side, and one at the posterior end known as the anal cleft. The colour is brown or green, with the margins darker. Owing to the flatness and the harmony of the colours with that of the leaf surface, the scale is not very readily observed on the plant. The length of the female is one-fifth of an inch. The male has not been observed in Queensland.

Distribution and Habits.

The species appears to have been taken only in Ceylon and Queensland. Green[1] records it from Dalbergia and Litsea in the former country, and W. W. Froggatt[2] states that he obtained it on Moreton Bay fig at Maryborough (Queensland). The only specimens obtained from citrus were taken in the Cooroy district, and this appears to be the first record of the insect from that host. It is not common even in the Cooroy district, and information on the species as a citrus-feeding insect is therefore very slight. Both surfaces of the leaves are chosen as feeding-grounds, and the insects settle on the blade and not necessarily close to the midrib. Froggatt noted that sooty mould was associated with the species at Maryborough, but in the light infestations seen at Cooroy this fungus was not present. Parasites of the scale appear to be fairly active, and none of the affected trees suffered appreciable injury over a period of two years when carrying light infestations.

Life History.

No work has been possible on the life history, and beyond the fact that young emerged in April, 1932, and did not mature before June of that year, nothing is known of the breeding of the insect.

PULVINARIA SCALE.

Pulvinaria scale, *Pulvinaria cellulosa,* was described by Green[1] in "The Coccidæ of Ceylon," Part IV.; there does not appear to be any known synonyms of this name.

Description.

The young (Plate 127, fig. 4) are very pale green, elongate, and very slightly convex. As development proceeds the colour darkens considerably. The insects usually become fixed on a twig with the anterior end downwards towards the limbs, and the conspicuous eye spots are therefore seen at the lower end of the specimens on the plant. The adult female (Plate 127, fig. 2) appears almost dark green to the naked eye, but with the aid of a lens it can be seen that the ground colour is light and that the dark colouration is confined to a series of spots. These spots are most numerous in the median area, and thus the colour becomes lighter as the margins are approached. The adult female is naked, elongate, and convex, and the anal cleft is well defined. The eggs are deposited in a snow white ovisac (Plate 127, fig. 1) composed of closely compacted cottony material. As the ovisac is built up the posterior of the insect is gradually raised, and finally the body of the insect, which dries out and becomes lighter in colour, is seen as a scale-like formation resting on the anterior end of the ovisac, partly covered with the white cottony secretion, and with the posterior end so raised that the whole is almost perpendicular to the surface of the leaf.

The male of this species has not been found in Queensland, and Green in his original description of the insect mentions that the male was not seen by him.

The length of the female is about three-sixteenths of an inch prior to the formation of the ovisac.

Distribution and Habits.

From the available literature it appears that *Pulvinaria cellulosa* has been found in Ceylon and Queensland only, and it seems probable that it was introduced to this State. Citrus is the only host plant of the insect known. In Queensland the species appears to be confined to the southern districts, and reaches its maximum numbers on the Blackall Range and the surrounding coastal country. Dry seasons appear to favour the development of the pest, but it is seldom found in the drier regions, and it would appear that high temperatures are a limiting factor in its distribution. It is seldom that an entire tree is infested by Pulvinaria, and even when very large populations are present they are confined as a rule to a few branches of a tree. The young scales almost without exception choose a twig when settling down, and from that time onward usually remain fixed until mature. Occasionally, however, an immature individual will suddenly commence to wander about the plant, and less often practically the whole of a colony in one position will move away to another part. The normal procedure, however, is to remain fixed, and these chance movements of positions are brought about mostly by unsuitable food supply, or similar unfavourable circumstances. When mature, the females almost invariably leave the twigs and take up a position on a leaf, and it is there that the formation of the ovisac takes place. Though the young are not readily seen, the presence of a large colony is usually betrayed because of this migration of adult females. The snow white ovisac is large and conspicuous, and further,

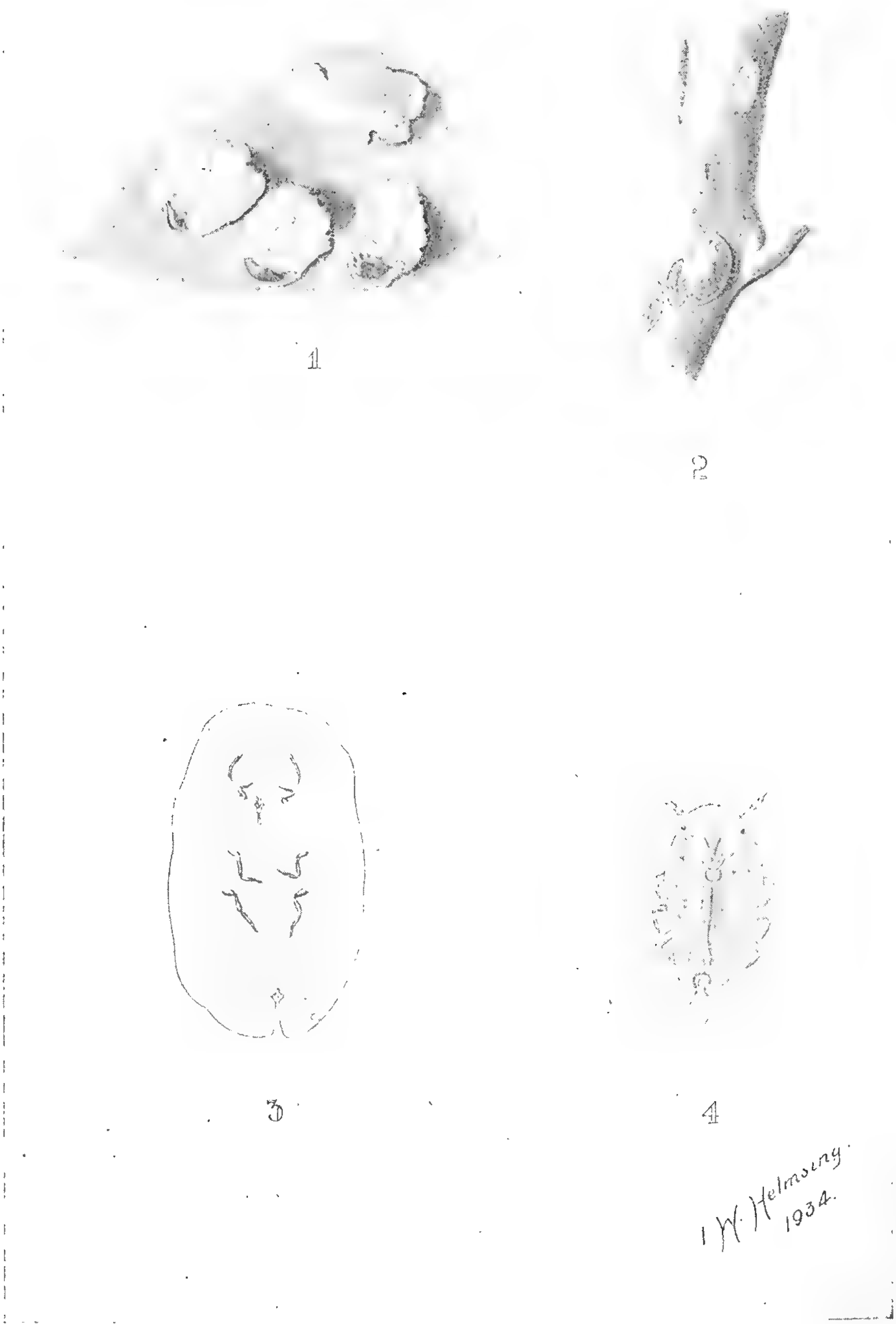

PLATE 127.

Pulvinaria Scale, *Pulvinaria cellulosa,* Green. Fig. 1, Females with ovisacs × 3. Fig. 2, Adult female and second stage nymphs on stem × 3. Fig. 3, Microscope mount of adult female × 8. Fig. 4, Microscope mount of first stage nymph × 60.

though it disintegrates soon after its function of housing the eggs is complete, a little of the cottony material remains adhering to the leaf for weeks or even months after the young have emerged. These remains mark the outline of the old ovisac, and the consequent scar-like marking produced on the leaves is very noticeable if present in any numbers. This is of value to the grower in the matter of combating the pest.

The Pulvinaria scale is not a very injurious insect, and small twigs may carry considerable numbers for several months before any appreciable damage is done. However, on older trees it is the fruit-bearing wood which carries the infestations, and the size of the fruit may be affected. Often the most objectionable feature of an infestation by Pulvinaria is that sooty mould accompanies it. The growth of this fungus may be very considerable, and as it is the bearing wood that is commonly infested, the fungus readily spreads to the fruit.

All varieties of citrus are susceptible to attack, but lemons are usually less heavily infested than neighbouring trees of other varieties. Very young trees usually escape heavy infestation, and it is on four to six year old trees that the largest populations are found. Provided, however, the tree carries a supply of tender twigs, climatic conditions constitute the only factor of importance in determining the incidence of the pest.

Whilst Pulvinaria cannot be considered a very important pest at the present time, it is still much more than a minor one, and its distribution within the districts where it occurs is undoubtedly becoming more general. Though the abnormally dry seasons recently experienced no doubt have had some influence on the position, growers would be unwise to rely too much on the probable return of normal seasons to cope with the increase. The control of the species should therefore not be taken lightly.

Life History.

There are two generations of Pulvinaria each year. Egg production is spread over two months, or a little longer, at the commencement of each generation. The winter is passed in immature stages, and ovisacs are secreted typically in October. A few may even appear late in August, whilst eggs are still to be found well into November. From the secretion of the ovisac to the emergence of young may require up to twenty-three days, but fourteen days is about the average. November, December, and January are spent in immature stages. Towards the end of January, or more typically early in February, reproduction is again commenced. A small proportion of females do not commence ovisac formation until early in March. The young then produced are those which give rise to the succeeding spring generation. Though there is a good deal of unevenness of the times of egg production by different females, this is of little moment, for the rate of development is so slow that overlapping of generations is only manifest for a few weeks, and in no way interferes with effective artificial control.

[TO BE CONTINUED.]

Tobacco Soils of Queensland.

By W. J. CARTMILL, B.Sc., Analyst.*

ALTHOUGH the tobacco districts of this State are distributed over a wide area the soils, in general, show a close similarity in type. This is explained by the fact that the demand at present is for tobacco possessing specific qualities, which experience has shown can be raised only on soils of a certain type.

The tobacco plant readily adapts itself to a wide range of climatic conditions; it can be grown on almost all types of soil, and it has a comparatively short season of growth. The crop could therefore be grown in any part of this State, excepting perhaps those areas where extremely dry conditions prevail. But while it can be so universally grown the quality and aroma of the leaf are greatly influenced by soil and climatic conditions. Obviously, then, the crop can be grown profitably only in certain districts which produce a leaf having certain specific qualities which render it acceptable to the manufacturers.

The industry has become specialised to such an extent that the demand is for leaf of a regular and uniform quality that can be adapted to certain specific purposes. It is not worth while growing a tobacco of a nondescript type, for this is both unprofitable to the grower and detrimental to the industry. The tobacco-grower therefore should understand what quality leaf is in demand, and the soil and climatic conditions which are required to produce this leaf.

So far as the soil is concerned, under given climatic conditions the type of tobacco produced will depend on the character of the soil, both as regards its physical and chemical nature, especially the former.

The physical composition largely determines the texture, which is an important property of all soils. The texture is an indication of the coarseness of the grains and is determined by a mechanical analysis of the soil, which consists in separating the soil particles according to their sizes into grades which are distinguished as sand, silt, and clay, and determining the quantities of each.

In order to produce a good quality tobacco leaf the plant must have a fairly rapid and uninterrupted growth. Several factors influence this, particularly climatic conditions and soil fertility; but the influence of soil texture is also great. The soil should be loose and friable so that moisture can permeate through readily, and not at any time tend to conditions of saturation.

There is evidence which seems to establish the fact that a well cultivated loose soil lessens the incidence of fungus diseases. As a rule the lighter the texture—that is, the less clay it contains—the thinner is the texture of the tobacco leaf and the more elastic, pliable, and better the quality of the leaf produced. In the case of tobacco, probably more so than any other crop, the texture and physical properties of the soil influence the physiology of the plant to such an extent as to determine and control the distribution of the distinct types of tobacco.

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* In a broadcast address from Radio Station 4QG.

Heavy fertile soils will not produce fine tobacco of any variety. Soils containing a large proportion of clay, or which for other reasons are very retentive of moisture, tend to produce large heavy plants which cure a dark colour. On the other hand, a light sandy soil produces plants with thinner leaves which by proper treatment can be cured to a bright yellow or light mahogany colour.

Cigarette and Pipe Leaf.

The type of tobacco produced in Queensland is confined almost entirely to that suitable for cigarette and pipe mixtures. These demand a thin, elastic, oily leaf of bright colour. The general type of soil found suitable for the purpose is an infertile sandy soil or sandy loam. On account of their infertility these soils, as a rule, are not well adapted to the production of most of the staple agricultural crops.

Tobacco has been grown in various parts of Queensland for upwards of sixty years, but it is only during recent years that the industry has taken a prominent place in Queensland agriculture. Hitherto a tobacco of a nondescript type had been produced, having been grown without much regard to the type of soil or climatic conditions, and for this product there was only a limited market.

Since tobacco is a crop that is grown mostly in tropical and semi-tropical climates, and on soils which are fairly infertile, one would expect to find in Queensland some areas suitable for the production of a desirable quality of bright tobacco. In 1927 and 1928 experiments were inaugurated by the Agricultural Department in collaboration with the Australian Tobacco Investigation to discover if such areas existed. Exploratory plots were laid out in various parts of a large area of country in North Queensland, extending from Mareeba down to Bowen and inland for a distance of about 200 miles. Several types of soil were selected as being likely to prove suitable for the crop. The results of these experiments were very encouraging, and further trials were laid out in 1928 and 1929 with equally good results.

Thus it was established that certain areas in the North had potentialities as being centres of a new and important industry. Since then other areas in the coastal semi-tropical parts of the State, where the soils bear a similarity to those in the North, have given promise of becoming important producing areas.

In North Queensland, the largest district is Mareeba in the Cairns hinterland. This district comprises a large tract of country extending from Mareeba proper westwards to Dimbulah, and is a number of square miles in extent. Further north the industry is being developed in the vicinity of Leura. Other areas in the North are Hervey's Range and Woodstock (near Townsville), Charters Towers, and Bowen.

The districts in Central Queensland comprise Sarina and Koumala (south of Mackay), Miriam Vale, and Bundaberg. A little tobacco is grown in the neighbourhood of Rockhampton.

In Southern Queensland the principal areas are Park Ridge (near Brisbane), Beerburrum, Inglewood, and Texas.

Mareeba.

The Mareeba area in the North is the most extensive in the State and embraces a large area of poor sandy hitherto undeveloped country. The topography is made up mostly of broad, gently sloping ridges, hilly and rocky in places. The country is drained by the Barron River and by several creeks which flow into the Barron. The natural vegetation is fairly dense but not heavy, consisting of stunted gums, bloodwood, box, ironbark, and ironwood; the grasses are mostly kangaroo, spear, and blady grass. The rainfall is moderate, most of which falls in the summer months. Though there are several types of soil in the district, four are distinct, the others being variations of these. In order of importance these types are—

(1) A grey sandy soil with a light-yellow sandy subsoil.

(2) A brown sandy soil.

(3) A red sandy to sandy loam.

(4) A white sand.

The soils are derived mostly from acid volcanic rocks such as granite and gneiss, while some of the red soils owe their origin to ferruginous metamorphic rocks. These red soils are finer grained than those derived from the granitic rocks and contain a higher percentage of silt and clay. The soils derived from granite and allied rocks are light in colour, fairly coarse grained, and infertile. The top soil has a depth of 8 to 12 inches, sometimes deeper, and merges into a sandy subsoil usually yellowish, though sometimes light grey in colour.

The mechanical analyses of these soils reveal upwards of 90 per cent. of sand with only about 3 per cent. silt and 2 per cent. clay. They are classified therefore as sands. In comparison with typical soils of the more important tobacco districts of the United States of America, these Mareeba soils are lighter. Analyses of North Carolina soils, for example, indicate that they contain from 70 to 80 per cent. of sand with 20 to 30 per cent. of silt and clay and are classified as sandy loams. In other words, they have more body. A sandy soil, particularly one of coarse texture, that carries only a small amount of silt and clay is not a very desirable type for several reasons. It is usually very infertile, has a poor water-holding capacity, and on account of its porosity water-soluble fertilizers added to it are readily leached out and lost during periods of wet weather. Such soils, too, are deficient in humus, which is an important soil constituent, influencing in a large degree the growth of the plant and the quality of the leaf.

The mechanical analyses of the subsoils closely follow those of the surface soils, showing a high percentage of sand, mostly of the coarse fraction, but slightly higher percentage of silt and clay, though these two are still relatively low.

There are in Mareeba areas of grey sandy soils whose physical composition closely approximates that of the American soils mentioned. Their silt and clay fractions together make up about 20 per cent. of their composition. They are more retentive of moisture and soluble plantfoods and produce a good yield of high quality tobacco.

The red soils owe their colour to the high percentage of iron oxide they contain. There are two types of red soil in Mareeba—a sandy infertile type formed from ferruginous metamorphic rocks; and a finer

grained, heavier, more fertile type formed from intermediate volcanic rocks such as andesites and diorites. This latter type is a sandy loam containing fair percentages of silt and clay, and its fertility permits of a crop being grown with the application of only a small quantity of fertilizer.

The white sandy soils are invariably coarse and infertile. They have no body and very poor water-holding capacity. Though these soils produce a bright leaf the yield usually is low for the large quantity of fertilizer that must be added to them; the leaf is thin and "papery," and consequently the return is not very profitable. They are formed *in situ* in elevated positions and are distinct from the light-coloured soils, usually small in extent, that occur near the bottom of ridges where there is a seepage or a poor drainage which has brought about the leaching-out of the organic matter.

The chemical analyses of most of the soils of the Mareeba district reveal that they are infertile and lacking in all the principal plantfoods and humus. Such, of course, is a feature of practically all bright tobacco soils, in which the fertility or amount of available plantfood must be limited and supplied in proportions that will give rise to a leaf possessing the desired qualities.

Dimbulah.

Much attention has been focussed on Dimbulah over the last few years on account of the large percentage of good quality leaf which has been produced there. This district, about 30 miles west of Mareeba, is mostly undulating country of sandy ridges. The country is drained by the Walsh River and several creeks. There are four main types of soil, all of which are tried for tobacco cultivation—

(1) A grey sandy soil.

(2) A light-brown to light-red sandy soil.

(3) A white sand.

(4) An alluvial sandy loam.

The soils are derived principally from granitic rocks. The grey sand is similar in mechanical analysis to the same type of the Mareeba district, being fairly coarse in texture with little silt and clay. It is usually underlain by a yellowish coarse sandy subsoil. In one area at Dimbulah is a grey sandy soil of lighter colour and texture, consisting mostly of fine sand with about 5 per cent. of clay. This area grows a good quality leaf but is not well elevated and mostly requires artificial drainage.

The light-brown sandy soils have a wide range. They are nearly always found on elevated sites that are well drained, and the type is much sought after. They are soils with a fair body, too, having up to 10 per cent. of clay and silt and the sand fraction, mostly fine. They are fairly retentive of moisture, and the humus content, though not high, is greater than the other types.

The white sands are not cultivated extensively. They are very infertile, coarse in texture, and practically devoid of humus.

The alluvial sandy loams occur on the flood plains of the Walsh River. They are the most fertile soils in the district, and consist largely of fine sand and silt. The humus content is fair. The leaf produced on these soils is mostly bright mahogany, with good body and texture.

The chemical analyses of the Dimbulah soils are, in general, similar to the corresponding types of the Mareeba district. They are deficient in all the principal plantfoods and in humus.

Hervey's Range.

In the Hervey's Range district, near Townsville, the soils consist largely of coarse sand. This, in itself, would be a defect were it not ameliorated by fairly high percentages of silt and clay, which in this instance is the case, giving the soil binding properties and adding to its water-retaining facilities. The country is elevated and surrounded by rocky ridges.

Woodstock.

At Woodstock, also near Townsville, are patches of sandy soil being used for tobacco cultivation. They are mostly grey medium-textured sands with fair humus content.

Charters Towers.

At Charters Towers the soil is of medium texture with low percentages of the fine fractions.

Bowen.

At Bowen tobacco is grown on fairly fertile alluvial soils at the delta of the Don River. On virgin soils the crop is grown without fertilizer, and some heavy yields have been recorded. The humus and nitrogen contents of these soils are fairly good. They are dark-grey and brown in colour. The mechanical analyses show high percentages of fine sand, but a low amount of the other five fractions. Soils from other parts of the Bowen district are mostly coarse sands.

Sarina.

The soils cultivated in the Sarina district, 20 miles south of Mackay, are grey and light-brown sands. Around Mount Chelona are brown and greyish soils on poor, coarse, sandy, and gravelly ridges. Similar in nature to these are the Blue Mountain soils near the coast.

Beerburrum.

Recently a large area of country has been opened at Beerburrum for extensive tobacco cultivation. Previously small crops grown in this area had produced leaf of high quality, indicating that conditions there appeared to be eminently suitable for the cultivation of bright tobacco. The topography of the country is made up of broad, gently sloping ridges of sandy soil draining off into swamps and creeks. The soils are derived from sandstones of marine origin. The most prominent type is a grey sand with a yellow sandy subsoil, the top soil having a depth of about 8 inches. It is a fine to a medium-textured sand with small amounts of silt and clay, though these fractions are, on the average, higher than in most of our bright tobacco soils. The humus content, on an average, is also higher, in this instance approaching the "fair" grade for sandy soils, and it is to this property of the soil that the high quality manifested by much of the Beerburrum leaf can probably be ascribed.

One other prominent type of soil in this district is a red sand and sandy loam. It occurs mostly in the Glass House Mountains area on elevated sites such as the crest of ridges. It is underlain either by a red sandy clay or clayey subsoil.

Park Ridge.

The soils of the Park Ridge area, about 20 miles from Brisbane, are similar in many respects to the Beerburrum soils. The main type is a grey sand underlain by a yellow sandy subsoil. The ridges are broad and elevated, draining off mostly into ti-tree swamps. The virgin soils have a fair humus and nitrogen content.

Texas.

In the Texas district, which is situated on the Southern border of the State along the Dumaresq River, tobacco has been cultivated for a number of years. The crop is grown under irrigation on flat country bordering the banks of the river. The type of soil most extensively cultivated is an alluvial loam and, being fairly fertile, a high yield is obtained without the aid of artificial fertilizer. This is not generally considered the best type of soil for growing tobacco, but it represents the character of the soil on which most of the tobacco is grown in this part of the State. Latterly, development has been down the river and about Yelarbon, where the soil is of a lighter type—a sandy loam—on which bright and fairly good quality leaf has been produced. Fertilizers are being used to advantage on some of these areas.

At Inglewood the soils are similar to those of Texas.

Summary.

Summing up, the soils of all our bright tobacco areas are, in general, infertile sands derived principally from granites and sandstones. They are deficient in all the mineral plantfoods and in humus. Tobacco is an exhaustive crop and requires fairly large quantities of the principal plantfoods. With an insufficient supply of any one, the plant readily responds to the deficiency with deleterious effects on the quality of the leaf. The plantfoods can be readily supplied in the form of artificial fertilizers, but the humus is a more difficult problem. The greatest defect of most of our tobacco soils is their deficiency of humus. What little the virgin soil contains is depleted considerably after a few crops have been removed. Green crops must then be grown and ploughed under to replenish the supply, and the practice repeated, if possible, after the removal of each crop.

Most of the tobacco soils so far analysed are slightly acid. This state of slight acidity is considered by authorities to be the optimum for the production of good quality leaf. Experiences in Queensland, however, are not exhaustive enough to enable us to draw conclusions as to the influence of soil acidity on the quality of the leaf. Each of our principal districts has produced some good leaf, which often has certain specific qualities, particularly with regard to aroma, which distinguish it. Each district has possibilities, but in order to get the best results a careful study of the soil and its treatment must be made. In order that the patient work of collecting data might not be hampered co-operative action between farmers and the Department is essential, for there is much to be learned before we can hope to produce consistently good quality leaf.

Problems of Wheat Production.

By R. E. SOUTTER, Wheat Breeder, and Manager, State Farm, Bungeworgorai.

THESE notes, although presented under the title of "Problems of Wheat Production," deal with soil erosion, a subject which concerns not only the wheatgrower, but every individual who directly or indirectly depends upon the products of the soil for his or her livelihood. So calamitous have the effects of soil erosion been in the United States of America, that it is calculated thirty million acres of first-class agricultural land have been rendered worthless, and an additional sixty to seventy million acres have been so seriously affected as to be nearly worthless. The same rapid deterioration due to the same agency is going on in most countries of the world, but more rapidly in those countries where the rainfall is at times torrential. These forces of destruction are at work in our own State, and there are many areas in the coastal belt which, after having been cleared of timber, in a comparatively short period have had their producing capacity so reduced by this cause as to be only fit for grazing, and even for this purpose their value is depreciating yearly.

Fortunately, it is possible to prevent this calamity, which it undoubtedly is, and still utilise the land for ordinary agricultural purposes, and that is by making contour drains. This system of preventing erosion has been practised in the United States of America for some considerable period with remarkable results. Coming nearer home, the New South Wales Department of Agriculture was quick to recognise its potentialities and gave practical demonstrations in several sections of that State, with the result that many private individuals have practised it, and so successfully in most instances that the area being dealt with is increasing each year.

During a recent visit to the mother State, I had the opportunity of inspecting areas which had been dealt with in this way at the Wagga and Cowra Experiment Farms. It was at Cowra, I understand, where this system was first tried, and in one location was so successful as to render a dam useless by causing the water to percolate instead of running off.

The following has been taken from an article on the subject supplied to me by the compiler, Mr. Kelly, Manager of Cowra Experiment Farm, New South Wales:—

Surface draining as a means of preventing erosion by controlling the water flow in the paddocks is by no means new, but owing to wrong methods the work done in many instances has not only proved fruitless, but has rather accentuated the injury it was attempting to control. In some cases this has been occasioned by the drains not being large enough, and in other cases through relying on the judgment of the eye to run out a drain. This latter method is the surest way to court failure. The old fallacy that ploughing in channels will arrest erosion has long since been exploded. Results can only follow a determined attack on the cause of the trouble. If paddocks have been eroded badly, the matter of restoration is both lengthy and costly.

Experience in America and at Cowra Experiment Farm has shown that the only successful and practical method of dealing with soil erosion is by terrace farming or the adoption of broad-base contour drains. By the latter is meant a banking of earth to arrest the flow of surplus water with a wide sloping drain on the upper side of the bank to collect the water and convey it to a suitable outlet. The gradual slope permits of the maximum absorption and reduces to a minimum, erosion of the drain itself.

The banks vary from 1 to 2 feet in height, 10 feet in width, and with the open drain of the same width. The banks should be of such a height and nature as to admit of the passage of teams across them so that there will not be any uncropped land, or idle ground for weed propagation.

Select a road, permanent pasture paddock or natural watercourse as the outlet for the drain if possible. If such are not available, a wide drain will of necessity have to be made, and the laying-down of this with lucerne or some other permanent crop will prevent erosion here. As the desire is to carry off the surplus water as slowly as possible, there are three points of paramount importance.

(1) That the correct *grade* be obtained in constructing the drain.

(2) That the drain and bank be of ample proportions.

(3) That the distance between the contour drains be kept in direct accordance with the area and slope of the land to be drained.

Dealing with the first point—*Grade*—experience has shown that a fall of 1 inch in 16 feet 8 inches (or 1 in 200) will give the requisite grade to carry water slowly and without damage to the drain, all things being equal. With the home-made level to be described later, the correct fall is automatically obtained.

With regard to the second point—*Capacity of drain* and dimensions of bank—this will be governed by—

(*a*) Area which the drain has to cater for.

(*b*) Slope of the area.

(*c*) Type of soil.

(*d*) Length of drain.

The further the drains are apart the greater the dimensions must be of the contour drains. The greater the slope the greater will be the velocity of the surface water over the terrace and in the drain, therefore the latter must be sufficiently large to hold and convey the water received.

The type of soil will have an influence; sandy soils and light loams absorb water much more rapidly than clay soils, therefore the latter will give a greater run-off, which necessitates the consideration of this aspect when laying out contour drains.

The longer the drain the greater the accumulation of water, and consequently increased capacity should be allowed for in the construction of it. Where possible the drains should not be long, for the shorter they are the less likelihood of the water breaking over them. As regards the point of ratio of surface to be drained and size of drain, the size of drain and height of bank have certain limitations due to several factors such as machinery available for construction and the working of cultural implements over the banks.

We now come to the third point—*Distance between the contour drains*—which will be decided by the slope of the land. This can be gauged by using a straight edge, 16 feet 8 inches in length. Place one end on the ground on the uphill side, and placing a spirit-level on the centre, raise the lower end of the straight edge until it shows level. Six times the distance from the ground to the raised end of the straight edge gives the fall in 100 feet. Generally a vertical distance of 9 feet between drains will prove satisfactory with minor alterations to suit peculiar conditions which exert a controlling influence. (This vertical distance would, in all probability, be far too great for Queensland.)

With a slope of up to 6 per cent. drains three chains apart have proved satisfactory, but with a greater slope they require to be correspondingly closer. Consideration must be given to any accumulation of water from grass paddocks or other sources on adjacent higher land.

Taking Levels.

For all practical purposes, accurate and satisfactory results will follow the use of the home-made level, which is made as follows:—

Of Oregon pine, 5 or 6 by 1, obtain one 8-foot length for upper stay, one 11-foot length for centre stay, on which rests the spirit-level, and two pieces 7 feet 6 inches long for the legs. Mark out on a floor or other level surface an isosceles triangle having a base 16 feet 8 inches long with sides 11 feet. Lay legs along side, keeping mark on the inside and allowing sufficient projection at base to cut on bevel. Next lay 8-foot piece across narrow end, allowing sufficient overhang to enable both legs and top stay to be cut flush, and nail securely. Place the other stay across, allowing sufficient projection at either end to cut flush with edges of legs, and nail one end. Stand upright and place spirit-level on centre stay and when it shows level make secure. If any doubt exists as to the floor or surface used being level, the following method can be adopted:—

Drive two pegs 16 feet 8 inches apart in the water at the edge of a dam so that the top of each peg is just level with the surface, then test. When proved correct, at each intersection bolt with two bolts. When these have been tightened up, test again, and if found level, cut an inch off one leg, and mark it upper. A frame for holding the spirit-level in position on centre stay whilst moving about will be found to save a good deal of inconvenience.

Before taking any levels make a detailed inspection of the area to be dealt with, which should afford some idea as to the volume of water to be catered for. The next thing is to decide as to the best place for the outlet. At times it is necessary to have central and intermediate channels for the final disposal of the water accumulated by the drain.

Drain-making should commence at the highest end of the paddock, for if started at the lower end and rain is experienced before the work is completed the drains made would not be capable of dealing with the run-off.

With the home-made level, pegs, and other equipment a start is made on the top drain from where it has been decided to have its exit. Place the long leg of the frame or level at this point and use as a pivot for moving the shorter leg backwards and forwards until the spirit-level shows level, then drive a peg in where the short leg rests; next move

the frame along until the long or lower leg rests alongside this peg and use as a pivot as before, and when level shows level insert another peg, and repeat until the other side of the paddock has been reached.

In view of the fact that one leg of the frame is 1 inch shorter than the other, the result will be a fall of 6 inches in 100 feet, or a half per cent.

As the ground varies in slope the drains will be found to wind a good deal and a number of sharp small bends will also be observed. These latter are due to minor depressions or rises and can be ignored when constructing.

The marked position of the drain having been defined, the construction can now be commenced, for which the following implements can be used, viz.:—

(1) Disc plough.
(2) Disc plough in conjunction with grader or delver.
(3) Mouldboard plough in conjunction with grader or delver.
(4) Grader or delver.

Of these the disc multiple-furrow plough is probably the most economical and as efficient as any to use. If available, a single furrow can be used to strike out along the line of pegs, throwing the sod downhill, which will give a good line for the multiple-furrow disc to follow as well as leave the pegs uncovered. With the disc plough the first furrows should be thrown uphill, allowing the front wheel to run in the furrow left by the single plough and backing this up from the upper side and so form a ridge in the centre, and continue in this way for three or four rounds according to whether the plough is a five or a four furrow. Strike out again at centre and continue for three or four rounds; then again strike out at centre and back up again for three or four rounds, according to number of discs. This procedure should normally provide a bank of sufficient height and a drain on the upper side capable of carrying off the water.

The running of an additional trip along the top side of the drain with the rear furrow very shallow will give the top side a gentle slope and also produce a certain amount of loose earth which can be worked over the bottom of the drain.

To level and finish off a spring-tooth cultivator should be run along the drain and the ploughing on either side of the bank. This operation not only consolidates the soil, but the tracks lead the water along the drain, and in addition a certain amount of good soil is spread along it and so ensures a better crop growth.

If a paddock has been scoured prior to putting in the drains, it will be found that in some places the banks will be too low and so will have to be raised and strengthened in order to prevent water breaking over, and to do this an earth scoop will be found most suitable. Stubble land is in the best condition for draining, as the passing to and fro of the teams and implements, &c., have consolidated and levelled the surface to such an extent as to render the surveying for the drain a very simple matter; nevertheless, well-settled fallow can be dealt with satisfactorily.

The first ploughing after draining should be along the line of contour to avoid crossing the drains, but after the banks have become consolidated it can be done in any direction.

Finally, never let the efficiency of the drains or banks become impaired or very serious damage may be the result.

Wheatgrowing in the Maranoa.

By R. E. SOUTTER, Wheat Breeder, and Manager, State Farm, Bungeworgorai.

QUEENSLAND, although not looked upon as a wheat-growing State, produces sufficient to meet her own requirements, and has the second highest average yield per acre in the Commonwealth, 15·18 bushels—being beaten by Tasmania with 21·78 bushels. With the adoption of a cultural system which has for its objective the conservation of moisture the discrepancy between these two averages can be reduced, seeing that varieties with increased rust resistance and ability to produce grain under adverse conditions have been evolved and are being improved upon.

Even in the more favoured districts of the Darling Downs, where the meteorological conditions are such that fair to good crops are obtained nearly every season, the practice of the short fallow would tend to raise the average, whereas in the Maranoa, where the rainfall is less, the adoption of the long fallow in conjunction with the short fallow is considered essential to success. That success can be looked for, will be gathered from the fact that in 1918 a 30-acre paddock worked on the long fallow sown to "Warren" wheat in May and harvested in October gave a return of slightly over 24 bushels to the acre, on a rainfall during the growing period of 1·96 inches. The yield obtained on the short fallowed section was 17 bushels.

During the 1931 season, the rainfall from May until the crops were ready for harvesting (October), was 3·71 inches; the yield from a small long-fallowed section was 24·4 bushels per acre, whereas the short fallowed portion gave a return of 16·5 bushels.

The average yield obtained on the short fallow over a period of seventeen years is 17·1 bushels, the average for the district over the same period being in the vicinity of 8 bushels.

That the yields just previously mentioned were the result, not of the rain which fell during the growing period, but of that which had been previously conserved in the soil, may be gathered from the fact that, according to recognised authorities, to produce, say, 15 bushels of wheat 4½ inches of water are required to pass through the crop, and for every extra 10 bushels 3 inches more are necessary. To produce the crop of 24 bushels in 1918 nearly 7¾ inches of water would be required. So, even supposing that all the rainfall (1·96 inches) was available to the crop (which it was not) it was necessary for the moisture content of the soil to be sufficiently high to permit of approximately 5 inches being furnished to the plants.

A glance at any rainfall chart will serve to show that in Queensland the season of the greatest precipitation occurs during the summer months when the weed growth is exceptional and evaporation greatest, and it follows that this must most assuredly be the season of greatest cultural activity so that the moisture may be trapped and conserved for the future crop's requirements.

What operation to carry out, and when, cannot be stated definitely, as experiments carried out to determine same only emphasise the fact that no hard-and-fast rules can be laid down, there being so many controlling factors, and it remains with the individual who is aware of the peculiarities of his case, and who should be armed with the knowledge which will enable him to surmount them.

Long and Short Fallows.

The difference between a long and short fallow is that in the former case the land is cropped every second year with wheat, and in the interim is worked so that the maximum amount of water possible from the rain experienced is retained in the soil; whereas the short fallow is cropped again the following year, cultural operations having immediately followed harvesting operations and continued until sowing time. With the adoption of the long and short fallow on a wheat farm, it is necessary to subdivide the area it is intended to crop into three sections; two of which will be sown the first year (short fallow), the other kept worked and sown as the long fallow quota in the following season. In the second year one of the two sown the previous year will again be sown (short fallow), and the other reserved for sowing next season (long fallow).

From the foregoing it will be seen that two-thirds of the area is cropped every year, half of which is on a long and half on a short fallow after the first year. At the Roma State Farm the *modus operandi* in connection with the short fallow, likewise the initial stages of the long fallow, is to commence cultural operations as soon as possible after the grain has been harvested.

If the soil is too dry for ploughing, the disc cultivator is run over it, with the result that the stubble is broken down (we seldom get a burn), weeds are checked and the surface is broken, which lets the rain in when it comes. To all appearances, sometimes very little good is being accomplished, nevertheless it is surprising how much longer ground treated in this way remains in good ploughing condition than if it were neglected.

Ploughing.

As soon as the land is in a fit condition to carry a team without injury after rain has fallen, ploughing should be gone on with. This does not necessarily apply to the land already disced, for, as stated before, this land will remain in good ploughing condition for some time longer than unploughed land.

Now good cultural methods in connection with wheat production at one time were considered to necessitate deep ploughing, but this has been shown to be a fallacy. Not only is it not essential, but it may at times be detrimental for, in our experience, when the work has been done late in the season, or when the conditions following have been unfavourable to consolidation, it has proved injurious and in seasons of very limited rainfall has resulted in failure.

The depth looked upon as giving the best results on most classes of soil is in the vicinity of 5 inches, which depth when worked up provides a good mulch and seed bed, and at the same time forms a fairly large reservoir for water should heavy rains be experienced, an essential on soils of slow percolocity.

After the initial operation of ploughing has been completed, the inverted soil is permitted to lie in the rough state for five or six weeks, or until sufficient rain falls to mellow it, so that heavy harrows will bring it to the desired tilth. All subsequent work must be in the direction of preventing the formation of a hard crust and weeds from growing, both of which tend to nullify the results of operations already carried out for the retention of moisture. This means that as soon after rain as possible it is imperative that the soil mulch, which will have been rendered ineffective, be restored.

Restoring Surface Mulch.

The implement to use for this purpose will depend on those available, but as a rule harrows, spring tooth, and a one-way cultivator are found on most farms, one of which will be capable of dealing effectively with any condition of the soil towards the restoration of the mulch.

Should the soil be of a good mechanical condition and not weedy the ordinary harrows will prove effective; whereas if it is weedy and the surface has set the one-way cultivator will have to be brought into use. If the ground is clean but set too firmly to respond to the harrows, the tooth cultivator is the best, for the reason that it does not reduce the mulch to the same state of fineness as the harrow. Whichever implement is used, the operation of restoring the soil mulch should not be attempted before the soil is in a condition to respond fully to the treatment, that is, when it is in its most friable state.

Depth of Mulch.

As a result of observations made on most classes of soils in many parts of Australia, it is considered by those in a position to know that from 2½ to 3 inches is the most economical depth. Anything shallower would not be effective, and a greater depth more costly in proportion to increase in effectiveness.

Depth of Sowing.

From 2 to 2½ inches is considered to be the most suitable depth to sow, although deeper sowing is sometimes practised on light soils to ensure germination; but even at 2½ inches on clayey loams, similar to those at the Roma State Farm, many plants would fail to reach the surface should heavy rain fall immediately after seeding, more particularly if other than graded seed had been sown.

Rate of Sowing.

This is governed by the variety and season of sowing, but as a general rule 30 to 35 lb. to the acre will suffice for early and mid-season (April to third week in May), whereas 40 to 50 lb. to the acre will be necessary on areas sown later.

Direction of Sowing.

All cultural operations carried out in the latter part of the season should be at right angles to that which it is intended to sow to ensure that all seed is well covered and germinates evenly. Otherwise where the drill runs in the same direction as a plough finish, a portion of the grain is just covered or left lying on the surface, with the result that it does not germinate until rain occurs, which, delayed for any length of time, causes unequal ripening, thereby hampering harvesting operations or affecting quality of grain.

Varieties.

On the sowing of suitable varieties depends the ultimate success of all a farmer's cultural operations.

Of the new wheats evolved and which have come into general cultivation, the bulk are very much earlier than their predecessors of some years ago, due to the fact that their earliness very often enables them to escape rust; and at other times in seasons of limited rainfall to produce grain under conditions practically fatal to slow-growing kinds.

This earliness, in conjunction with indiscriminate sowing, is no doubt a contributing factor to the extra damage done when late frosts are experienced. In an endeavour to mitigate this to some extent, the season for sowing those varieties grown most extensively in the Maranoa will be given.

Variety.	When to Sow for Grain.	Rate in lb. per acre for Graded Seed.
Amby .. Cleveland	End of April to end of May (second week)	30 lb. per acre
Currawa Warchief Warren	Good varieties to sow on locations subject to late frosts	
Bunge .. Cedric ..	May and June	May (first and second week), 30 lb.
Clarendon Gluyas .. Nabawa	May and June	May (third and fourth week), 40 lb.
Novo .. Reward Three Seas	May and June	June, 50 lb.
Flora .. Florence Watchman	From May (second week) ..	May, 40 lb. June, 50 lb.

Reward, which is a small, shotty red-grained wheat, had better be sown at a rate of 5 lb. to the acre less than the others.

The foregoing has not been designed for the low-lying lands adjacent to creeks, which are susceptible to heavy and late frosts, so it will be necessary for the individual farmer to make allowances. From the varieties he has previously grown, he will probably decide that those in No. 1 can be sown early in May, No. 2 after the second week, and No. 3 in June.

Harrowing the Crop.

This should be carried out after rain, across the drills, when the plants have a firm hold in the soil and as soon as the soil will carry a team satisfactory.

This operation, which results in a loosening of the surface, preventing evaporation and leaving it in the best condition for the reception of more, also retards the growths of weed seedlings, induces deep rooting and possibly increased tillage.

Deficiency of Winter Feeding on Natural Pastures.

By J. L. HODGE, Instructor in Sheep and Wool.*

IT would appear from current press reports and letters received from graziers by the Department of Agriculture and Stock that at last stockmasters are waking up to the fact that natural grasses in winter time are, on a great many properties, insufficient to maintain health in sheep, and especially lambing ewes and weaners. From as far out as Winton and Longreach information has reached this office of a feed deficiency in the winter months even on the Mitchell grass plains when apparently grass is plentiful. This, I think, may be attributed to constant stocking with sheep over a comparatively great number of years and insufficient care on the part of those in charge of properties in the matter of systematic spelling of paddocks with the idea of allowing the indigenous grasses to seed.

A few years ago, comparatively, it was difficult to convince some graziers that their sheep were suffering from malnutrition during the winter months. To the inexperienced eye there was plenty of feed, and it was not recognised that the better and softer indigenous grasses had, to some extent, disappeared. The idea of semi-starvation was not generally accepted. It is admitted that the conditions as described apply more to the pastures closer in, where the stocking with sheep has been of longer duration and heavier stocking has been the more common practice.

The question naturally arises as to what should be done to remedy this state of affairs. For the far-west and central districts, it would appear essential that a proportion of the run should be allowed to seed each year. This does not mean that the grazier would entirely lose the benefit of that country. Sheep could be depastured after the grasses have matured and the seed has fallen.

Overstocking should be generally discouraged and every effort made, having due regard for economy, to get the property back into "good heart." If the grazier would realise that, over a period of years, it was to his financial benefit to stock comparatively lightly, we would hear less of the evils of winter grass deficiency. Subdivision of the country would certainly help in the regrassing of the run where the cost of fencing is not prohibitive. The full advantage to be gained from spelling paddocks in rotation is then easily assured. At the present time regrassing is impracticable. It would therefore appear, to a great extent, that the question of better winter pastures is in the hands of the graziers themselves.

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* In a broadcast address from Radio Station 4QG.

The Value of Suitable Licks.

The grazier may help the stock through the trying winter months by supplying a suitable lick. It has been found that the addition of a protein is useful and profitable for the purpose.

I recommend the following:—

	Parts.
Nauru phosphate (finely ground)	40
Salt (butcher's quality)	40
Sulphate of iron	4
Epsom salts	4
Linseed meal, cotton meal, maize meal	12
	100

Here you have phosphoric acid necessary to all animal life, a necessity in salt, a tonic in the iron sulphate, a laxative in the epsom salts, and the protein recommended in the meal. The lick may be given with safety all the year round, if necessary, to dry sheep, but a great proportion of the salt should be taken out of the lick if it is proposed to supply ewes half way through the period of gestation. This is recommended on account of the fact that with the meal added the ewe is likely to take too much salt with ill-results.

Deficient Pastures on the Darling Downs.

On the Darling Downs the overstocking of natural pastures applies to an even greater extent than on far-out areas.

The holdings are very much smaller and have carried sheep for a longer period and, in addition, it must be admitted that the practice of overstocking has been more common, to the detriment of the indigenous grasses.

On the Darling Downs a greater opportunity exists to do something useful in the way of pasture improvement, as apart from ordinary cultivation. The Department of Agriculture and Stock has initiated an experiment there with the idea of trying out, in a practical way, certain grasses and clovers for winter feeding. We feel that something useful will result, and full information will be published in due course.

Winter Crops for Sheep.

Cultivation of small areas on the Darling Downs must come into general practice if sheep, and especially fat lambs, are to be raised profitably. Wheat, barley, and oats are all recommended. They are excellent crops for the winter feeding of sheep, and there is, of course, the prospect of a cereal crop. Lucerne cannot be too highly spoken of. Taken all round, there is no better sheep feed grown, and it is surprising where it does grow.

All farmers grazing sheep are advised to sow Rhodes grass on newly-cleared scrub land. The grass has been proved to do well on this class of country, and is a great feed both for sheep and cattle. The farmer growing wheat is losing some of his legitimate profit if he does not run some sheep. Even if breeding is not practicable, sheep acquired as stores are a necessity in most seasons for the good of the crop itself. Wheat lends itself splendidly to the fattening of old sheep, which would

be a hopeless proposition on natural winter pastures. This fact itself should be a great inducement, if such be needed, to farmers to provide adequately for their sheep in the matter of feed during the winter.

The costs of the Downs lands being what they are make it essential, if a fair return on capital outlay is to be obtained, that the farmer should get more out of his land without impoverishing it than can be yielded from indigenous pastures. Everyone engaged in dairying admits this, and the same applies when running sheep.

Cultivation and Fat Lamb Raising.

The Department of Agriculture and Stock has commenced an experiment in fat lamb raising with the idea of finding out the best crosses for the raising of fat lambs, both for home consumption and export.

In every case where English type rams have been loaned to farmers under the scheme a certain amount of cultivation has been insisted upon, it being recognised that the raising of early maturing fat lambs on natural pastures is not to be recommended. It is believed that the results will go far, not only to demonstrate the crosses wanted, but to prove to farmers on the Downs the economic necessity of winter feeding. All engaged in the fat lamb industry should realise early that the lamb must follow the plough. Another point of material importance is the loss in weight of wool in a poorly-fed sheep, in comparison with one properly nourished. It is safe to say that two adequately fed sheep will yield more to the grower than three half-fed animals.

The question of internal parasites in sheep is of no small importance when proper nutriment is under discussion. A well-fed sheep is far more resistant to this pest, and it is able to stand and responds much more readily to the necessary treatment.

From every point of view it pays the farmer to make the necessary provision for adequately feeding his stock during the winter.

We may regard ourselves as fortunate, in comparison with other countries, in that winter housing of stock is not necessary under our genial climatic conditions.

DROUGHT FEEDING OF SHEEP.

In spite of the fact that it is generally held that a sheep must have bulk to accommodate its large digestive organs, it is interesting to speculate, pointed out the officers supervising a drought-feeding trial with sheep at Hawkesbury Agricultural College in their report, how far the lack of bulk (which consumes in its digestion an amount of energy disproportionately high to the value extracted from it) is responsible for the good results shown by a ration of 12 oz. of maize, and the relatively poor results from rations in which the basic 4 oz. of maize was supplemented by roughages of low fat and high fibre content (oaten hay and mixed oaten and lucerne hay).

The indications are that when sheep are on a maintenance or sub-maintenance ration the conservation of muscular energy (by confinement to a relatively small area) becomes an important point, and is a natural corollary of conservation of digestive energy (by minimising the fibrous content of the ration). Such a procedure would be limited in practice by the possible incidence of worm infestation consequent upon fouling of the ground, but it would be reasonable to expect better results by concentrating sheep in handy 50 or 100-acre paddocks, changing as frequently as possible, than by allowing them the run of large paddocks, even with the extra picking of roughage.

Pig-feeding.

By L. A. DOWNEY, H.D.A., Instructor in Pig Raising.

[PART I.]

The subject of animal nutrition is a very complex one, and while there is a vast amount of data on the subject, and there are many useful scientific publications, Queensland pig raisers are still in need of information in a simple form, telling how scientific findings can be put into practical use on the farm. An endeavour has been made by Mr. Downey in these notes on pig-feeding to give the farmer a little clearer insight to this important subject and to avoid technicalities as far as possible. Research work on nutrition is still progressing, and, consequently, information given now may be altered by future findings.—ED.

THE ability of pigs to make economical gains in weight is determined by their breeding, management, and feeding. Well-bred thrifty pigs that are well cared for and kept in good health will make the best use of the available foods, but at the same time the old saying that "half the breeding is in the feeding" is very true regarding pigs.

The pig is a vigorous feeder, thriving on both animal and vegetable food—in fact, preferring a mixture of both. There are very few foods which he will not relish, provided they are wholesome. Decomposed foods should not be used. The pig has a comparatively small stomach and is not able to consume large quantities of bulky foods as the cow, sheep, and horse are; therefore, while a little roughage is desirable, concentrates should predominate in a pig's ration.

In most circumstances, full feeding, either by hand or self-feeder, is a wise practice and, provided the animal receives a complete and balanced ration and the necessary exercise and is bred to the desirable type, it will produce a desirable carcass at the required weight; but if small-type pigs are being fed to bacon weights, limited feeding must be practised. While the nature and composition of a pig's food affects the proportion of fat and lean in the carcass, the inherent conformation and the environment are also important factors.

Up to the present, pigs have been kept in Australia chiefly to utilise by-products from other industries, more particularly the by-products of the dairying industry, and when such foods are available cheaply they form the basis of pig-feeding rations. While pig raising is dependent on other industries for food supplies, the selection of foods and the preparation of rations will depend almost entirely on the availability of by-products; but when pig raising is undertaken as a special business, then provision of a food supply is a different matter, and the selection of foods to be grown or purchased requires very keen attention.

No one of the foods commonly used for pigs in this country is in itself sufficient to make a satisfactory ration, and to get the best from the basic foods, the farmer should add to them other foods which will improve their capacity to produce large gains in the pigs. These added foods may be either home-grown or purchased, according to the circumstances.

The pig raiser should know what quantity of food his pigs are using to make a pound of pork, and whether the value of that pork is sufficient to pay for the food as well as labour and other charges. When foods have to be purchased, their cost must be considered as well as their feeding value and their suitability when used in combination with other foods.

Maintenance.

Food is usually given to animals with the object of producing growth, work, milk, &c., but before any of these can be produced, the animal body must be maintained,—i.e., the body heat must be kept up, waste tissue must be replaced and the necessary energy for the movement of body muscles must be supplied. Approximately half the food given to a young pig is used for maintenance before any growth can be expected; this explains why the quicker the animal is grown the greater the amount of food saved on maintenance.

The normal body temperature of pigs is between 102 deg. Fahr. and 103 deg. Fahr. This temperature must be maintained. There is a continual production of heat in the body through tissues being oxidised (burned) and there is a continual cooling of the body through evaporation and radiation from its surface. On account of its thick skin and thick layer of fat beneath the skin, the pig does not perspire freely and so must be kept cool by radiation.

The growth of young animals is dependent on a supply of food in excess of a maintenance allowance, and with pigs this is perhaps the most important object in feeding from the practical viewpoint, for, having produced the young pigs, the farmer's object is to grow them rapidly and as economically as possible.

In mature breeding stock food is used not only for maintenance, but for the production of young. After the birth of the young, the sow has to secrete milk to feed them for a couple of months. This means an extra call on her body which must be supplied with the necessary food.

The laying on of fat is nature's way of laying up a reserve of energy and heat in the animal body, and animals at any age, if supplied with sufficient food, will store fat in the body. There is, however, a greater tendency to store fat when the animal is past the early growing stage. The fat is stored in layers between the skin and the muscle in the internal cavities of the body, and intermingled within the muscle fibres. This latter is known as marbling in lean meat.

Some Definitions.

Digestion.—Digestion is the process of changes which foods undergo while they are in the digestive tract of the animal, when they are separated into the portion to be assimilated and the portion to be excreted directly.

Assimilation.—Assimilation is the absorption of the useful portion of the digested food within the body.

Nutrient.—Nutrient is a substance used in the nutrition of animals.

Digestible Nutrient.—Digestible nutrient is that part of a crude nutrient which can be assimilated by the animal.

Ration.—Ration is the quantity of food given to one animal for twenty-four hours, whether it is given in one or several feeds.

Balanced Ration.—Balanced ration is the total quantity of food, containing the various digestible nutrients in the correct proportions, given to an animal in twenty-four hours.

Maintenance Ration.—Maintenance ration is the quantity of food required by an animal for body maintenance only, for twenty-four hours.

With the exception of air, water, and sunlight, all requirements of animals come either directly or indirectly from plants, which are able to gather certain elements in the form of chemical compounds from the soil and air, and with the aid of sunlight, manufacture plant products which are later used as animal foods.

The plant obtains water from the soil through the roots, and air is taken in by the plant through the minute openings called stomates on the lower side of the leaves; nitrogen, which is an important element in plant and animal nutrition, is obtained chiefly from the soil in the form of chemical compounds known as nitrates. However, leguminous plants such as lucerne, clover, and peas carry on their roots nodules which contain nitrogen-fixing bacteria which have the power of collecting free nitrogen from the air of the soil and supplying it to their host plants. Minerals such as phosphorus, potassium, and calcium are taken up as chemical compounds from the soil by way of the roots. Water supplies hydrogen and oxygen, and some oxygen is also obtained from the carbon-dioxide of the air, as is the carbon. All these substances are necessary for plant life and having obtained the required supply of these the plant is able to manufacture its various plant compounds which build up roots, stems, leaves, flowers, and seeds. The plant foods are carried to the leaves of the plant by the sap, and the green colouring matter of the leaves (chlorophyl), together with the sunlight, act on the plant foods in such a way as to change them into substances known as starches and sugars. Some of these compounds are then further changed into more complex substances within the plant and are used to build up plant tissue, to store up reserve tissue or to produce seed. These substances, produced by the plant, are known as carbohydrates, fats, and nitrogenous compounds.

Carbohydrates.

These consist of sugar, starch, and fibre and make up the larger portions of plants; they are fat, heat, and energy producing substances of animal foods. Sugars and starches are more digestible than fibre, and in grains they are more plentiful than fibre, whereas in hay the fibre content is about equal to that of starch and sugar.

Fats and Oils.

Fats and oils are similar in composition, but fats are solid under ordinary temperatures, while oils are liquid. These compounds are mainly the reserve food supply in the seeds of plants; they are particularly plentiful in peanuts, cottonseed, and linseed. Both carbohydrates and fats are composed of hydrogen, carbon, and oxygen, but carbohydrates contain approximately two and a-quarter times more oxygen than do fats, with the result that when they are burnt (oxidised) in the animal body the fats and oils give off approximately two and a-quarter times as much heat as do carbohydrates.

Nitrogenous Compounds.

By adding nitrogen and other elements to the carbohydrates, the plant builds up substances known as nitrogenous compounds or crude proteins. This group of substances includes proteins and amides or amino acids. Proteins are largely used in the production of milk, for growth and for reproduction in animals. Young plants which have not reached maturity contain a larger proportion of protein than older plants which contain larger quantities of fibre.

PLATE 128.
Grade Large White growers on a self-feeder at the Maroon Homestead Farm. They should be nicely finished when they reach bacon weights.

Mineral Matter.

Mineral matter is contained in all plants in varying degrees; the younger growth of plants has a higher percentage of useful minerals than the older portions. The chief mineral elements required by the animal are calcium and phosphorus, although several others are necessary in small quantities. When stock are fed on plants containing ample quantities of the necessary minerals, there may be no need to add more minerals to the ration, but in some cases, and especially where young or pregnant animals are being fed, the addition of a mineral supplement to the ration is an advantage. Several mineral mixtures are on the market and their use is often preferable to the farmer making his own, for they are usually complete and thoroughly mixed.

Iron as a Preventive of Anæmia.—A lack of iron in the sow's milk has been proved to be the cause of anæmia in young suckers, the anæmia being indicated by a paleness in the pigs, a wrinkling of the skin, and diarrhœa. The trouble occurs from the time the pigs are born until they commence to eat solid foods. Where sows and litters are run on pasture the anæmia does not occur, as the pigs receive iron from nosing in the ground, but in intensive pens where pigs have no access to soil, trouble may be anticipated unless precautions are taken. Simple means

of prevention when litters are penned consist of giving either a supply of mineral mixture containing sulphate of iron or a quantity of fresh soil or turf in the pen where the suckers have access to it.

Vitamins.

Vitamins are substances present in foodstuffs about which knowledge is, as yet, limited. It is known, however, that the vitamins, of which there are several known varieties, are essential to health, growth, and reproduction of animals; and if any one of them is not supplied in the foods, trouble will occur in the stock. As the various vitamins are present in most of the common stock foods, there is little risk of deficiency when a good variety of foods is given, and particularly when grazing is provided.

Salt.

Salt, as well as being a necessary compound in animal nutrition, is valuable as an appetiser, and for this reason it is used as the base of most commercial mineral mixtures for stock. An excess of salt has a poisoning effect on pigs.

Water.

Water is another essential for animal health, and all stock should receive all the water they require at frequent intervals. Water takes its part in practically every body function, and a large proportion of the body is made up of water. Where animals are fed excessively on very watery foods such as separated milk, they drink very little water, if any, but when dry foods are given, large quantities of water are required by pigs.

Air and Sunlight.

Fresh air and sunlight are both necessary for health and growth in stock, and it is advisable to allow animals access to both. It is also necessary to provide exercise to maintain normal functioning of the body.

Digestibility of Foods.

Although a chemical analysis of a food shows the quantities of crude protein, fats, fibre, and nitrogen-free extract the food contains, it does not indicate the proportions of the substances which are really available to the animal for nutrition. As only a portion of each nutrient is digestible, the remainder is lost from the animal body in the excreta. The food, on being taken into the mouth, is chewed and more or less ground to a finer consistency and mixed with saliva. It then passes on to the stomach and intestines, and it is subjected to the action of the various juices which are secreted in the body; bacteria also work on the food. This process dissolves the foods into compounds, some of which are then ready for assimilation.

Food nutrients are digestible to varying degrees, and the percentage of a nutrient that is digestible is known as its digestibility coefficient. The digestibility coefficients are determined experimentally by analysing foods, then feeding them to animals, and collecting all the excreta, which is then analysed, and the quantities of nutrients found to be left after digestion has taken place are said to be indigestible, and the differences between these quantities and the original quantities indicate what was digested by the animal. In considering the nutritive value of foods, it is the digestible nutrients that are used.

In practice the quantity of fibre in a food is a fairly good indication of its digestibility, fibre being very resistant to digestion.

Nutritive Ratio.

In calculating the nutritive value of a food, the percentage of digestible proteins, carbohydrates, and fats may be added together, after multiplying the fats by $2\frac{1}{4}$ to allow for their extra heat-producing capacity. The total is known as the total digestible nutrients.

If the sum of the digestible carbohydrates, plus fats multiplied by $2\frac{1}{4}$, be divided by the digestible proteins, the resultant ratio is known as the nutritive ratio. Different classes of stock require different nutritive ratios; for example, young growing stock and breeding animals require a greater proportion of proteins than do fattening stock.

PLATE 129.
W. F. Kajewski's Piggery, Glencoe, via Gowrie Junction, where pigs are kept under grazing conditions.

The nutritive ratios of different foods vary; for example, separated milk, which is comparatively rich in proteins, has a ratio of 1 part proteins to about 1·4 parts of carbohydrates, plus fat x $2\frac{1}{4}$, and this ratio is stated as 1 : 1·4. Maize grain, which is particularly rich in carbohydrates, has a ratio of about 1 : 12.

Foods carrying a large proportion of proteins are called nitrogenous foods, and have a narrow nutritive ratio. Those carrying a large proportion of carbohydrates and fats are called carbonaceous foods, and have a wide nutritive ratio. Young growing pigs require about 20 per cent. of protein in their ration at weaning time, and by the time they are 150 lb. live weight their requirement is down to about 15 per cent. protein.

Palatability.

Foods which are pleasing to the taste of animals are said to be palatable. Palatability is affected not only by the actual composition and condition of the food, but by the custom of the animals which are being fed. For example, if pigs have been accustomed to eating maize grain on the cob, and are suddenly changed over to ground maize grain, they sometimes do not relish the change; and if the change had been reversed, this dislike would probably also have been noted. Foods which are very palatable to an animal stimulate digestion, and therefore give better results in feeding. Also, when maximum gains are desired it is wise to give a palatable food mixture to stimulate food consumption. Dry foods containing a large quantity of fibre are usually less palatable to pigs than succulent foods and good grain. When certain unpalatable foods are available cheaply and it is desired to make most use of them, the addition of some more palatable food will often increase the palatability of the ration.

Succulence.

Succulent foods, such as young growing green crops or root crops or grass pasture, are appreciated by stock, and have the additional advantage of acting as a laxative. The palatability of succulent foods increases their consumption, and so leads to greater production.

Variety.

It is important in animal feeding to give a variety of foods at all times. However, sudden changes of diet should not be made. When the animal regularly receives a good variety of foods in its ration, there is little risk of a deficiency of any of the necessary nutrients, and the ration is more palatable to the animal. Even when the feeder lacks a knowledge of the principles of feeding, if he gives the stock a sufficient variety of foods good results will usually be obtained.

Concentrates, Roughages, and Bulk.

Foods which contain a comparatively low percentage of fibre are known as concentrates. They are highly nutritious. The various grains, as well as pollard, meat meal, and linseed meal, would come under the heading of concentrates.

Roughages are foods such as fodder crops, pasture, hay, and silage, which contain a comparatively large quantity of fibre and little digestible nutrients. Foods such as root crops, pumpkins, and melons do not contain large quantities of fibre, but are watery, and for this reason are usually classed as roughages or bulky foods. Separated milk, buttermilk, whey, and soup are also classed as bulky foods as they contain a very high percentage of water, although their fibre content is nil.

Preparation of Feeding Stuffs.

Any benefit to be derived from the preparation of a food will depend on its character and condition and on the animal. With most foods cooking is unnecessary for pigs, exceptions being offal and English potatoes, also milk products which are suspected of carrying the tubercle bacillus. In cold weather pigs prefer warm food and drink, and this

should be attended to where practicable, as it will increase the palatability and help maintain the body heat, portion of which would otherwise be utilised to heat up the cold food in the digestive tract. While it is usually wise to force pigs to chew their foods, the small grains are more digestible when they are ground, crushed, or rolled, and even maize, which may be well chewed and digested at times, is often improved by grinding; although pigs, if accustomed to the method of feeding, will make economical use of maize either on the cob or as whole, shelled grain.

When the small, hard grains cannot be crushed, ground, or rolled, they should be soaked or boiled to soften. Lucerne chaff or hay is sometimes steamed or soaked to increase its palatability for pigs, although after pigs become accustomed to these foods they make good use of them dry.

Quantity of Food to Give.

The growth, appetite, and condition of the pigs are the feeder's best guide in determining quantities of food to use, but for convenience in calculation, the following may be taken as approximate requirements to produce rapid growth in pigs:—

Live Weight of Pigs.	Minimum Daily Allowance per Pig of Protein-rich Foods. Sep. Milk or Buttermilk.	or *Meat Meal, etc.	†Daily Allowance per Pig of Grain or its Equivalent.
	Gallons.	Lb.	Lb.
20 lb.	½	¼	½
40 lb.	¾	½	1
60 lb.	¾	½	2
80 lb.	¾	½	3
100 lb.	¾	½	4
120 lb.	¾	½	5
140 lb.	¾	½	5½
160 lb.	¾	½	6
180 lb.	¾	½	6½
200 lb.	¾	½	7
Brood Sows (Dry)	¾	½	5–6
Brood Sows with Litters (over two weeks)	1½	1	10–12

* When a minimum of ¾ gallon of separated milk or butter-milk daily per pig is available, there should be no necessity to use meat meal or similar protein-rich foods, excepting in the case of sows with litters, which require 1½ gallon of milk.

† When other foods are used to replace some or all of the grain allowance, it may be estimated approximately that 1 lb. of grain equals—

4 lb. Sweet Potatoes,
4 lb. English Potatoes,
5 lb. Arrowroot,
6 lb. Pumpkins,
8 lb. Mangolds,
5-10 lb. Green Pasture or Forage Crops,
1 gallon Separated Milk or Butter-milk (undiluted),
2 gallons Whey.

When pigs are receiving large quantities of protein-rich forage such as lucerne, cowpeas, or field peas, the maximum requirement of protein-rich food such as milk or meat meal will be less than shown above. It should be remembered in using bulky foods to replace grain

that pigs have a limited capacity for such foods, and better results are usually obtained by feeding at least some of the grain requirement as grain; this applies more to young pigs than to brood sows.

Good pigs which are full fed should gain an average of 1 lb. live weight daily from 20 to 100 lb. and require an average of 3½ lb. of grain equivalent to make that 1 lb. gain. From 100 to 200 lb. the average daily live weight gain should be approximately 1½ lb., with a food requirement of approximately 4½ lb. grain equivalent for each 1 lb. gain.

[TO BE CONTINUED.]

A CHEAP WINTER RUG FOR DAIRY COWS.

Where proper shelter is not provided for stock, not only is their resistance to disease reduced, but much food material is wasted in "warming the wind," or in other words meeting the increased demands of an exposed body. This fact has an important application for dairy farmers. A cow's food is only devoted to production after the animal has satisfied its needs for nourishment and heat. In assisting the cow to conserve the lastmentioned, shelter belts in the form of trees and hedges have considerable utility on the dairy farm, especially in colder districts and situations, and for the same reason the rugging of the animals during at any rate a portion of the winter is well worth while.

Many farmers would like to rug their cows, but cannot afford to purchase the market article. The farmer can, however, make his own cow rugs for little more than the cost of two or three cornsacks or other heavy bags, a ball of twine, and a sewing needle, plus his own ingenuity, points out a leaflet issued by the New South Wales Department of Agriculture. Two bags, or three for larger cows, will make an effective rug if utilised as follows:—

Split the bags down the seams and join together and place on the cow. Next cut off a strip from 10 to 18 inches wide so that the rug will not hang too low. This need not be wasted; it is folded, and when sewn to the rug provides the strap for the thighs, this being the only strap used. The front is now fitted by turning up the front corners and sewing them to the sides of the rug. This strengthens the rug and obviates the necessity for cutting off the spare portion which the cow would tread on. The two turned-back portions are then measured and sewn to fit fairly tightly to the cow's neck. The back strap is fitted 12 to 15 inches below the rump level, and the rug is complete.

This home-made rug will keep the cow warm, and after a few days' wear, when the oil, &c., from the cow's body has worked into the rug, it will also be waterproof. The rug can quite easily be slipped off and on over the cow's head, and it is advisable to remove it daily except on rainy or very bleak days. The cow's name painted on the rug over the rump with tar prevents confusion in replacing the rugs.

A trial on one or two cows will prove the efficacy of these rugs, the animals soon showing their appreciation in a practical manner.

Cockerel-raising Experiments.

Report by P. RUMBALL, Poultry Expert, and J. E. LADEWIG, B.Sc. Agric.

The White Leghorn fowl, by reason of its size and class, is not generally regarded as a table bird. In fact, as soon as chickens reach an age which enables sex to be determined, it is the general practice to destroy the cockerels. They are thus a total loss to the industry. If they could be reared economically to the "prime roaster stage," a small profit would be acceptable to the poultryman. These experiments, which were conducted at the Animal Health Station, Yeerongpilly, were designed to investigate the cost of raising cockerels on rations which can, in the main, be home-produced.

The tests were conducted with cockerels six weeks of age. One lot was reared in pens and one lot in batteries.—Ed.

PEN-REARING TESTS.

IN these tests 86 cockerels were used. They were divided into three groups of 28, 28, and 30 birds each.

These birds were reared in pens 5 ft. wide and 20 ft. long. Their liberty was considerably restricted in consequence.

Rations.

Simple rations were fed in two instances with the object of encouraging the utilisation of surplus supplies of skim milk and meals that could be made on the farm. The other ration was similar to that used by many commercial poultry farmers for the rearing of stock—

Group 1 were fed twice daily upon a ration composed of 80 per cent. maize meal and 20 per cent. semi-solid butter-milk.

Group 2 were fed twice daily a mash of 80 per cent. wheat meal and 20 per cent. semi-solid butter-milk.

Group 3 were fed upon an all-mash, which was kept constantly before the birds.

The average crude protein content of the different rations was as follows:—Group 1, 11·5 per cent.; Group 2, 14·7 per cent.; Group 3, 15 per cent.

Rate of Development.

Except during one week, fairly uniform growth was maintained in all pens up to the age of sixteen weeks; from this period onwards the

rate of development in one pen showed a marked difference, and with the object of illustrating the variation in the three pens, Table I. has been prepared:—

TABLE I.

SHOWING AGE, GROUP, AVERAGE WEIGHT OF BIRD, AND COST OF FEED PER BIRD.

Age.	Group 1. Maize and Milk.		Group 2. Wheat and Milk.		Group 3. All-Mash.	
	Weight of Bird.	Cost of Feed.	Weight of Bird.	Cost of Feed.	Weight of Bird.	Cost of Feed.
Weeks.	Oz.	*d.*	Oz.	*d.*	Oz.	*d.*
6 ..	17·3	..	17·1	..	17·9	..
16 ..	42·7	11·0	43·1	11·1	48·9	11·3
17 ..	46·7	12·2	47·1	12·4	55·1	12·6
18 ..	46·7	13·5	47·7	13·8	56·1	13·9
19 ..	51·6	14·9	52·6	15·6	58·2	15·1
20 ..	54·5	16·4	55·7	17·3	61·3	16·3
21 ..	55·1	17·9	56·0	18·6	60·6	17·4

From Table I. it will be noted—

1. That the birds fed on all-mash were as heavy at seventeen weeks as were those fed maize and wheat at twenty-one weeks.
2. That the cost of feeding from the age of six weeks until the cockerels attained the weight of 55 oz. was—All-mash, 12·6d.; wheat and milk, 17·3d.; maize and milk, 17·9d.
3. That the rate of development appeared to be somewhat associated with the crude protein content of the ration.

BATTERY-REARING TEST.

In this test sixty cockerels were used, penned in lots of 10.

The feeding was based upon the principle of the farmer using farm-grown and manufactured meals plus milk. In this test, as in the former, semi-solid butter-milk having a crude protein content of 20·8 per cent. was used. Approximately four times the quantity of skim milk would be necessary as a substitution for the semi-solid.

Rations.

——	Section 1.	Section 2.	Section 3.	Section 4.	Section 5.	Section 6.
Maize meal	80	40	..	60	90	..
Wheat meal	..	40	80	..	5	50
Semi-solid milk	20	20	20	40	5	50
Crude protein content of ration	11·5	13·1	14·7	13·8	9·9	17·0

In addition to the above, green chaffed lucerne was fed once daily, and shell grit, charcoal, and water were kept before the birds at all times.

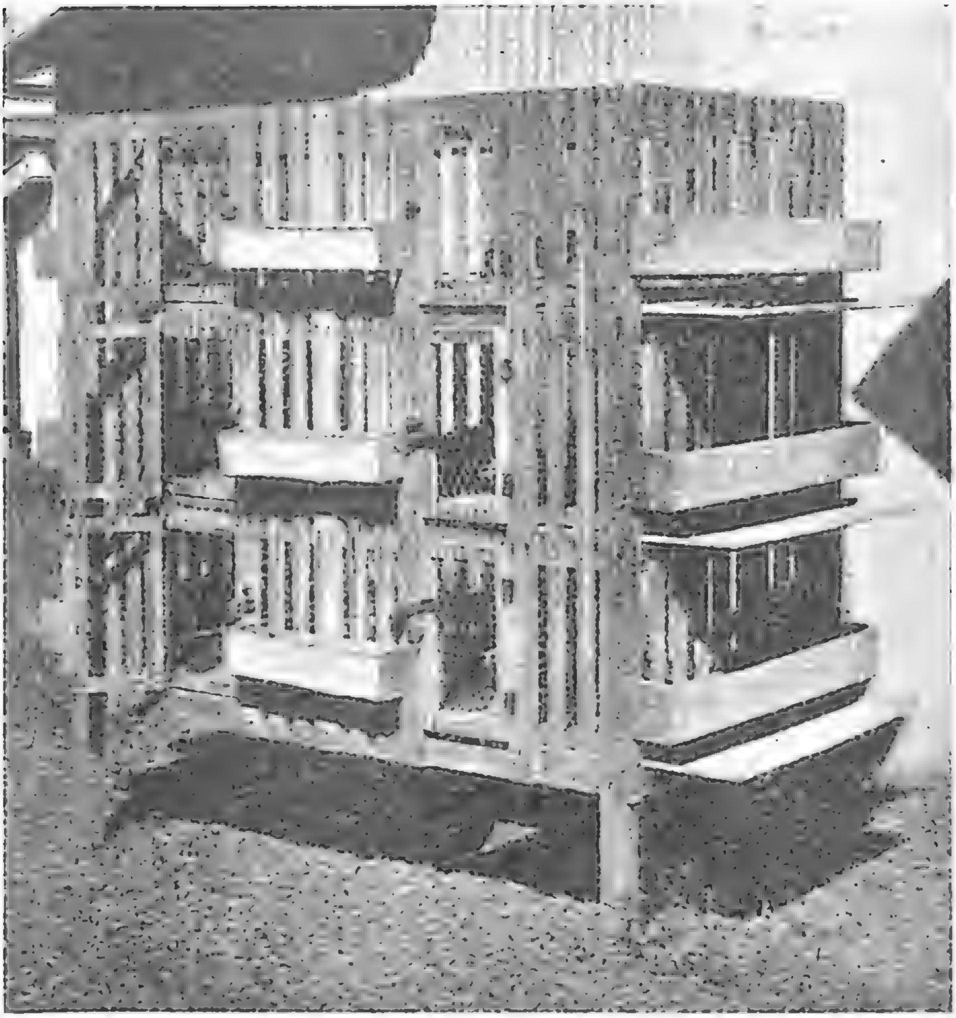

PLATE 130.

Battery used in the Cockerel-feeding Experiments, showing three decks, wire floors (with tray underneath to catch droppings), and outside feed and water vessels.

The quantity of food supplied was varied in accordance with the appetite of the birds. There appeared, however, to be a definite relationship between consumption and the butter-milk content of the ration, the rations having the higher content being favoured.

Rate of Development.

In order to indicate the progress development, Table II. has been prepared, commencing when the birds were fourteen weeks of age, as one group at this age were as heavy as the best group in the pen-rearing tests were at seventeen weeks.

TABLE II.

SHOWING AGE IN WEEKS AND WEIGHT OF BIRD IN OUNCES.

Weeks.	Section 1.	Section 2.	Section 3.	Section 4.	Section 5.	Section 6.
	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.
14	40·5	39·2	38·7	49·7	37·5	56·3
15	43·2	41·2	40·5	52·0	39·3	59·6
16	46·2	43·8	44·4	55·1	43·1	63·3
17	47·0	44·2	47·0	58·2	46·0	66·3
18	49·7	43·1	47·0	58·4	48·4	66·1
19	51·4	43·7	47·3	59·3	49·7	65·9
20	53·8	50·4	49·2	61·8	52·0	66·6
21	55·2	55·7	53·3	61·7	53·1	65·4

From Table II. it will be noted that Section 6 attained the weight of 55 oz. in fourteen weeks. This ration had the highest protein content of any, and, as in the pen-rearing test, it is suggestive that rations of a relatively high protein content are more efficient for the rearing of cockerels for table purposes. This ration also contained the highest amount of butter-milk, which undoubtedly stimulated consumption.

The cockerels in Section 6 increased in weight between the ages of six and fourteen weeks by 39 oz., an average gain of nearly 5 oz. per week. During the next two weeks they put on 3 oz. per week in weight and then remained almost stationary. It appears, therefore, that the most economic stage of development is reached with this system of feeding when the bird is from 55 to 60 oz. in weight, and consequently should be disposed of at or about that weight.

The next section to reach the 55-oz. mark was Section 4. This ration had the third highest protein content, but its semi-solid milk content was twice that of Sections 1 and 3.

This additional quantity of milk undoubtedly increased consumption, with the natural consequence of more rapid development.

FINANCIAL ASPECT.

Every breeder has for his object the rapid development of cockerels for table purposes. Early development reduces the plant necessary, and the flesh of the young quick-grown bird is preferred to that of the older slow-grown bird.

In order to indicate the costs of production under the various systems of feeding adopted, Table III. has been prepared indicating the milk content of the ration, age, weight of bird, and cost in pence—

TABLE III.

Section.	Milk Content of Ration.	Weight of Bird.	Age.	Cost in Pence.
	Per cent.	Oz.	Weeks.	*d.*
6	50	56	14	13·8
4	40	55	16	14·3
2	20	55	21	15·2
5	5	53	21	12·5
3	20	53	21	14·6
1	20	52	21	15·6

From the foregoing table it will be noted that the cost of rearing cockerels in Section 6 to fourteen weeks of age was slightly greater than was the case in Section 5, where the birds were kept to the age of twenty-one weeks.

In determining the most economic rearing ration the breeder must take into consideration the cost of food, the time occupied to obtain results, and the condition of the flesh of the bird. When this is done the choice in this instance would be given to Section 6.

It must, however, be pointed out that where good results are obtained by feeding a relatively costly ration, the advantages gained can easily be lost by holding the birds for a week or so beyond the most economical period for marketing.

In these experiments the cost of rearing has only been given for the food used from the time the cockerel chickens were six weeks of age.

Cockerels are generally reared to the age of about six weeks with the pullets, then culled and sold. The market value at this age would be in the vicinity of three pence per chicken; therefore this amount should be charged to the costs.

The cockerels reared in the tests realised 1s. 9d. each. In the pen-feeding tests the best results were obtained for an expenditure on food of 12·6d. To this must be added the market value of the chicken at six weeks—viz., 3d. Therefore the profit over cost of feed was 5·4d. per bird.

In the battery tests, the most economical development was obtained for an expenditure in feed of 13·8d. Adding the value of the chicken brings the costs to 16·8d; consequently, the profit over costs in this instance was only 4·2d. per bird.

It naturally must rest with the farmer to decide whether the raising of cockerels of the Leghorn variety for market is justified. The prices realised for the birds from these tests are not encouraging, but it must be pointed out that the average value was depreciated by retaining some of the groups until the birds became a trifle staggy.

SUMMARY.

The results from these tests indicate—

That the battery system of rearing is efficient.

That the best results were obtained by the feeding of a ration carrying a slightly higher protein content than that usually used for growing pullets.

That as milk induces consumption and is a desirable protein-rich food, it should be used in all rations in some form when easily obtainable.

That variety in the ration appears to give the most economic results, and appears a necessity to increase economically the protein level.

Land for Grazing Selection.

SESBANIA RESUMPTION.

SESBANIA Resumption is situated from 20 to 30 miles northerly and westerly from Corfield, on the Hughenden-Winton Railway, and embraces three portions, with areas ranging from 30,000 acres to 46,500 acres. The blocks will be open at the Land Office, Hughenden, on Thursday, 7th June, for a term of lease of twenty-eight years, at annual rentals of two pence and one penny farthing per acre for the first seven years of the term.

Portions consist of high open downs, with well-shaded channel country along the creeks, and are well grassed with Mitchell, Flinders, barley, blue, and other grasses. The land is good fattening and wool-growing country, and two of the blocks are sufficiently shaded to make good lambing country.

Water supplies are obtained from three bores, two of which are flowing, and one block is already sufficiently watered.

Other improvements comprise a cottage, hut, yards, and fencing.

Each selection will require to be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years, and proof must be furnished of the financial standing and pastoral or land experience of the applicants.

Free lithographs and full particulars may be obtained from the Land Agent, Hughenden, the Land Settlement Inquiry Office, Brisbane, and the Government Intelligence and Tourist Bureaux, Sydney and Melbourne.

Queensland Weeds.

By C. T. WHITE, Government Botanist.

MIST FLOWER (Eupatorium riparium).

Description.—A spreading herbaceous weed with numerous stems to a single plant, the stems decumbent at the base and rooting at the lower nodes. Leaves opposite, lanceolate in outline, varying somewhat

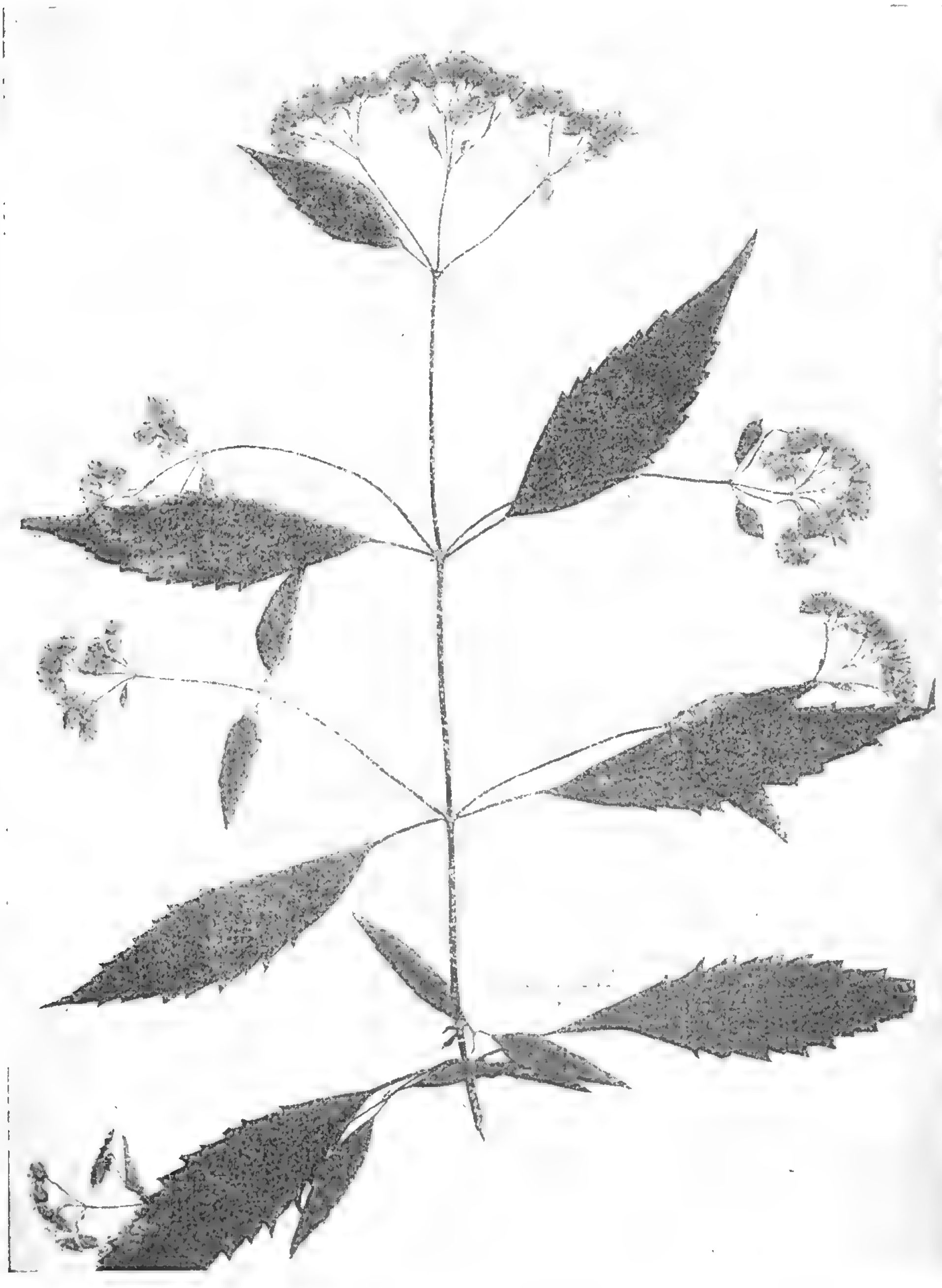

PLATE 131.
Mist Flower (*Eupatorium riparium*).

in size, but the adult ones mostly about 3 inches long and 1 inch wide, tapering at the base into a slender leaf stalk or petiole of about 1 inch; margins deeply and coarsely saw-toothed. Flowers white, the individual flowers very small and borne in small dense heads, the heads arranged in terminal sprays or corymbs 3 inches or more across. Seeds (achenes) slender, one line long, angular and hairy on the angles, surmounted by about twenty fine white hairs (pappus); the hairs themselves very finely barbellate or plumose.

Distribution.—A native of Mexico introduced into Queensland as a garden flower, now established as a weed along streams and in wet places generally in South-eastern Queensland.

Botanical Name.—*Eupatorium* commemorates Eupator, King of Pontus, who is said to have used a plant of this genus in medicine; *riparium* (Latin), referring to its preference in growing along creek banks.

Properties.—It is not known to possess any harmful or poisonous properties. It is frequently grown in bush-houses and in shady flower beds as an ornamental plant. In Europe and North America it is cultivated to a limited extent as a florists' flower.

Eradication.—So far as I have personally observed, the plant is confined to creek banks and wet situations generally. The plant has been gazetted a noxious weed, however, at the request of the Nerang Shire Council, who report it to be a serious pest on farms in the wetter country towards the ranges in their shire.

When the weed is too abundant to be dealt with by hand-pulling or hoe-chipping, it should readily succumb to an application of weak arsenical spray. Where the use of arsenic is undesirable on account of grazing stock, "Weedex" or other sprays containing calcium chlorate could be used. For plants such as Mist Flower a $2\frac{1}{2}$ per cent. solution should be sufficient. The Agricultural Chemist (Mr. E. H. Gurney) advises that though reports have been received stating both sodium and calcium chlorates are safe so far as stock are concerned (stock having been grazed without ill-effects in paddocks where vegetation has been sprayed with these substances), care should be taken that stock are not allowed to get at tins containing the concentrate or unused spray.

Botanical Reference.—*Eupatorium riparium* Regal in "Gartenflora," vol. xv., p. 324, tab. 525.

TO SUBSCRIBERS—IMPORTANT.

Several subscriptions have been received recently under cover of unsigned letters. Obviously, in the circumstances, it is impossible to send the Journal to the subscribers concerned.

It is most important that every subscriber's name and address should be written plainly, preferably in block letters, in order to avoid mistakes in addresses and delay in despatch.

Agricultural Notes.

By H. S. HUNTER, Agricultural Branch.

Seasonal Prospects.

THE month of April opened with rains which were welcome owing to the dry conditions of March. Unfortunately, the Darling Downs, where a good downpour was most needed, received but little benefit, and the falls which were recorded in that area were of a very scattered nature. Further rains west of the range would permit of the sowing of early wheat and other winter-growing cereals, and provide a start for crops sown in some instances on a dry seed-bed. In many cases, on the heavy soils, the breaking-up of the land is being delayed owing to its hard condition, due to the compacting action of the heavy January-February rains followed by the dry conditions of March.

In the coastal districts the rains persisted throughout the first two weeks of the month and, between waterlogging and the absence of sunlight, a good deal of injury was occasioned to ripening root, grain, and fruit crops. Flooding again occurred in the far-northern areas, and minor floods were experienced in local areas in the South.

Sugar.

With continued rains and fair atmospheric temperatures, the progress of the cane crop was reasonably satisfactory in all areas. The backward cane in the far North has shown but little recovery, however, and excessive rains during the month of April have further spoiled its chances of making good. Grub damage is making itself evident from Innisfail to Cairns, and large areas have been completely destroyed by the pest.

The Burdekin and Mackay areas promise heavy crops for the coming harvest; in the former area, particularly, the yield per acre may exceed the high figure attained in 1933.

The well-drained soils of the southern districts have benefited from the continued heavy rains, and crop growth on these areas has been fully maintained until the recent cold spell. Where drainage is not satisfactory the crop has suffered, and water-logging is serious.

On the whole, the Queensland crop would appear to be well up to the average of recent years. More precise data in this respect will be gathered during May.

Maize.

The harvesting of the mid-season maize crop now is in full swing, and some excellent yields are being obtained. The late-sown crop also holds good promise, except in the Darling Downs areas, where the yield will be affected by lack of rain. All maize-growing districts in Southern Queensland yielded a good crop of early maize, and the total yield for the season should be well above the average. Unfortunately, market prices are at a low level, and, as a consequence, many growers are storing their grain for use on the farm or until prices improve.

Wheat.

Practically all of the season's wheat now has been delivered to the Pool. The quantity received up to the first week of April amounted to 3,936,806 bushels. The total yield should be in the vicinity of 4,350,000 bushels.

Cotton.

The harvesting of the cotton crop continues at a good rate. Very heavy receivals are arriving daily, particularly at the Glenmore ginnery, where over 3,000 bales have already been ginned. Owing to the better yields in the Central district it has been found necessary to reopen the Gladstone ginnery, where good consignments are steadily arriving. Whilst the rate of receivals has not been so heavy at the Whinstanes ginnery, it is anticipated that more than a normal crop will be treated there, as reports from the various districts indicate nice yields except in the more southern sections, where climatic and insect troubles have lowered the season's crop, particularly in the Central district, is better than that of last year.

Dairying.

The output of dairy products is now suffering a seasonal decline, but the season's production will eclipse all previous records. Queensland this season has displaced Victoria as the chief butter-exporting State of the Commonwealth. Victoria's exports, which, up to 18th March last, amounted to 27,487 tons, are 11,149 tons less than for the corresponding period of last year. The falling-off can be attributed, no doubt, to the heat wave conditions which occurred on two occasions in the southern part of the continent. Queensland, with the assistance of an unusually favourable season, has increased its exports in the same period by 4,515 tons to a total of 28,855 tons.

The attention of statesmen and dairymen has again been directed to the question of restricting exports of butter. The principle of the restriction of production of primary products is a world-wide and, in Australia, a momentous question of concern, not only to the producer but to the whole community. Practically every product exported from Australia is either subject to or threatened with some measure of restriction from forces operating beyond the borders of our country.

Potatoes and Arrowroot.

Both of these crops suffered to some extent in the coastal districts, particularly in badly drained localities, from the continuous wet weather early in the month. Shortage of supplies from the Southern States has resulted in an appreciable rise in potato values on the local market, and as the crops of Victoria and South Australia suffered from the heat wave, the Queensland crop should meet with good prices when it comes on the market.

The arrowroot crops on the South Coast were adversely affected by rain on the lower areas. On the higher ground good yields should be harvested, but decreased areas and unfavourable conditions may result in the total yield being about 200 tons less than that of last year.

Tobacco.

The curing of tobacco leaf is being carried out in most districts, but the total yield will be considerably less than in 1933. With the current season, many areas of land which have proved their unsuitability have been abandoned or devoted to other crops. The season was far from suitable for the raising of seedlings, mainly owing to the prevalence of blue mould. In numerous instances growers who had failed to raise seedlings in their first attempt later succeeded by adopting the use of sprays recommended by the Department, but many of these beds were sown very late in the season, and it is feared that the growers concerned have little chance of harvesting a satisfactory crop.

French Beans.

SUPPLIED BY THE FRUIT BRANCH.

A CONSIDERABLE variety of beans is grown in Queensland, but it is generally recognised that, for all-round commercial purposes, the Canadian Wonder holds first place. Another variety, Feltham's Prolific, reputably hardy and a good cropper in New South Wales, is grown fairly extensively in some districts, but an unbiassed comparison of the two varieties from all aspects leaves the balance in favour of Canadian Wonder.

Planting usually takes place from September to April, though sowings may be made earlier according to the district's susceptibility to frosts.

In many parts of the State great difficulty is experienced in raising a crop during the hot months due to the ravages of a small fly for which up to the present there is no satisfactory control. During the colder months this pest disappears, and in the coastal districts free from frosts planting may be done at this period. The hilling of the plants, after they are about 6 to 7 inches high, at times assists in partially overcoming the damage caused by the fly. Rotation of crops and destruction of all plants after the crop is harvested are helpful in disease and pest control.

In preparing the land for market garden crops, along with cultivation, they generally require the free use of well-rotted stable or other manure, but in the case of beans the application of a heavy coat of such manures often results in the plants producing an abundance of foliage with resultant loss of bean pods. Beans, therefore, are suited by a well-cultivated soil, and preferably one that has been manured for a preceding crop. Failing this a light dressing of artificial manures rich in phosphates or potash will have a beneficial effect.

The Agricultural Chemist, in his pamphlet on Complete Fertilizers, advises:—Beans grow well on almost any soil, but prefer a well-drained clayey loam. Like all leguminous crops beans require lime, and the soil should contain a fair amount of this plantfood. Apply per acre, according the quality of the soil:—

> None to ½ cwt. of nitrate of soda; 2 to 3 cwt. Nauru phosphate—superphosphate mixture; ¾ to 1½ cwt. of sulphate of potash.

When the beans are grown to be eaten green, the amount of nitrogenous manure can be considerably increased, using 1 cwt. of nitrate of soda applied in three or four portions as top dressing, which greatly improves the succulence and flavour of the pods. Use from 3 to 6 cwt. of a 0-14-8 or 2-12-6 mixed fertilizer per acre.

For use in gardens apply per square yard: ¼ oz. nitrate of soda; 2 oz. superphosphate; 1 oz. sulphate of potash; or 3 to 4 oz. of the 2-12-6 mixture, followed by two or three top dressings of ¼ oz. nitrate of soda.

Planting is usually done by striking out shallow drills and dropping the seeds by hand and covering by light harrowing. The rows are usually 2 feet 6 inches to 3 feet apart, with 6 to 8 inches between the plants, and 35 lb. of small or 52 lb. of large seed is sufficient to plant an acre.

Horse cultivation is usually carried out, but it is not advisable that this work should be commenced in the early morning or at any time when the crop is wet, as the spores of certain diseases are more easily carried under these conditions.

Weeds should be kept in check, as they will seriously affect the growth of the crop.

The maximum output of beans can only be gained by picking thoroughly as they become fit, that is, when young and tender; otherwise they will begin to form seed, and the plants will cease to bear marketable beans.

Medicinal Value of the Pineapple.

A RECENTLY published report by Dr. J. R. Killian,* the distinguished American scientist, on the nutritional value of canned pineapple, indicates that this popular fruit may be extensively used by doctors and dentists in their fight against pyorrhœa. Dr. Killian's report, which is the result of two years' research at the University of Hawaii, has, amongst other things, established canned pineapple as one of the most consistently reliable anti-scorbutics available throughout the seasons. Dr. Hanke, of the University of Chicago, has found, during an intensive study of dental disease and diet, that many striking cures of pyorrhœa and dental decay have been effected by the consumption of large quantities of anti-scorbutics, which are rich in vitamin C. Canned pineapple, it has been established, has as high a vitamin C content as the anti-scorbutics used in Dr. Hanke's experiments, and has also a high content of vitamins A, B, D, and G.

In experiments undertaken in connection with the Indian disease, beri-beri, which is a nutritional disorder, canned pineapple was found to contain the vitamin B (B1) in sufficient quantities to prove very valuable in combating the disease. Canned pineapple, the report adds, was found to be a good source of iron, copper, and manganese, essential to a proper diet, in a readily assimilable form. Test meals were given to a large number of subjects, and it was found that the incorporation of pineapple in the meal stimulated the protease activity in the stomach and definitely speeded up digestive process.

While the vitamin content of fresh vegetables varied considerably with the season of the year, the report adds, the vitamin content of pineapple was not injured by canning, and maintained a consistent level throughout the season.—"The Agricultural Gazette" of New South Wales.

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* "Australian Food Manufacture," 5th January, 1934.

PLATE 132.
The Barron Falls, North Queensland.

PLATE 133.
Lake Barrine, bordered by dense tropical jungle, Atherton Tableland, North Queensland.

Plate 134.
The Barron River near Kurunda, North Queensland.

PLATE 135

Outlook from Wootha, near Maleny, South Queensland, the Glasshouse Mountains in the distance.

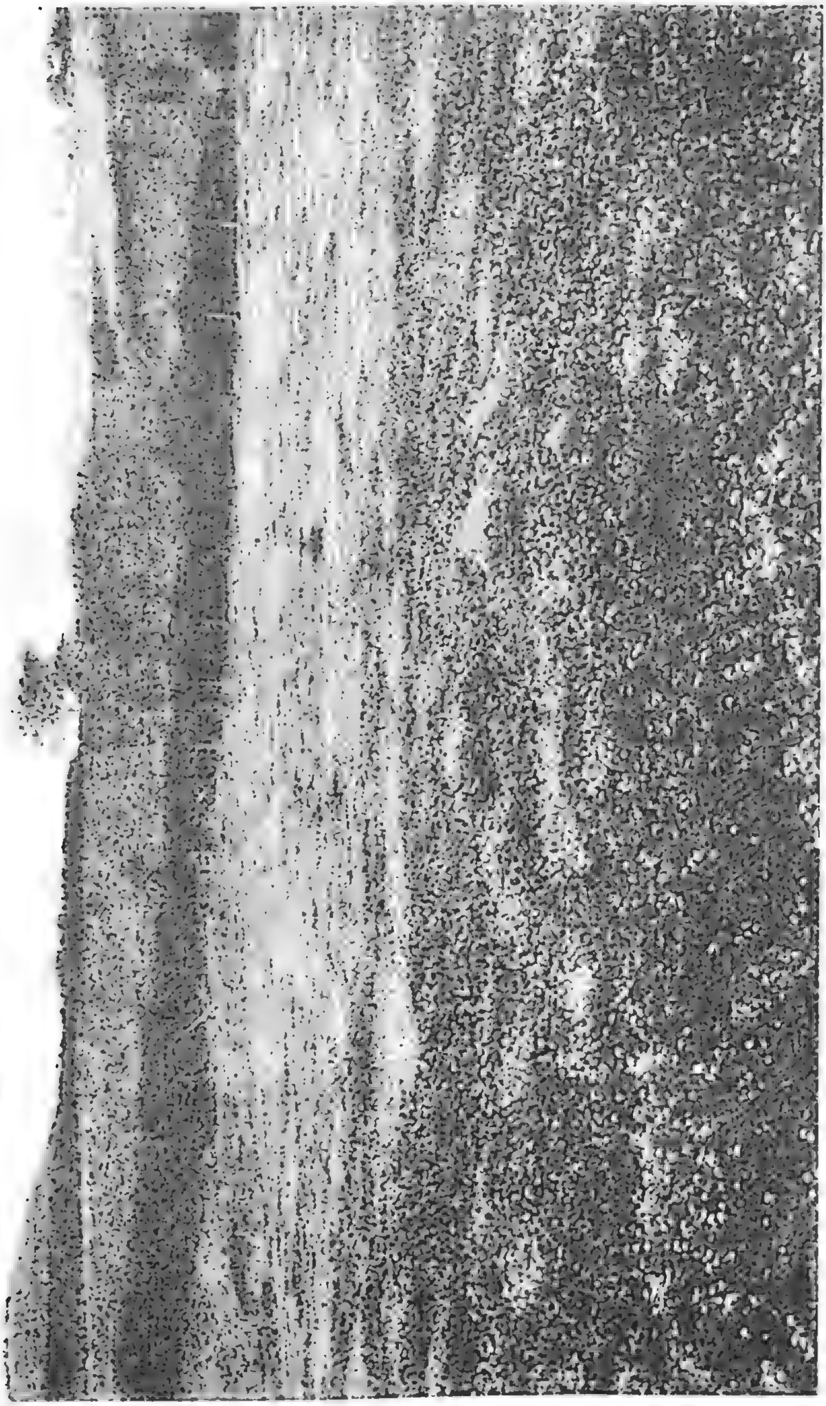

PLATE 136.

A field of clover, Mr. Cole's home farm, Maleny, South Queensland.

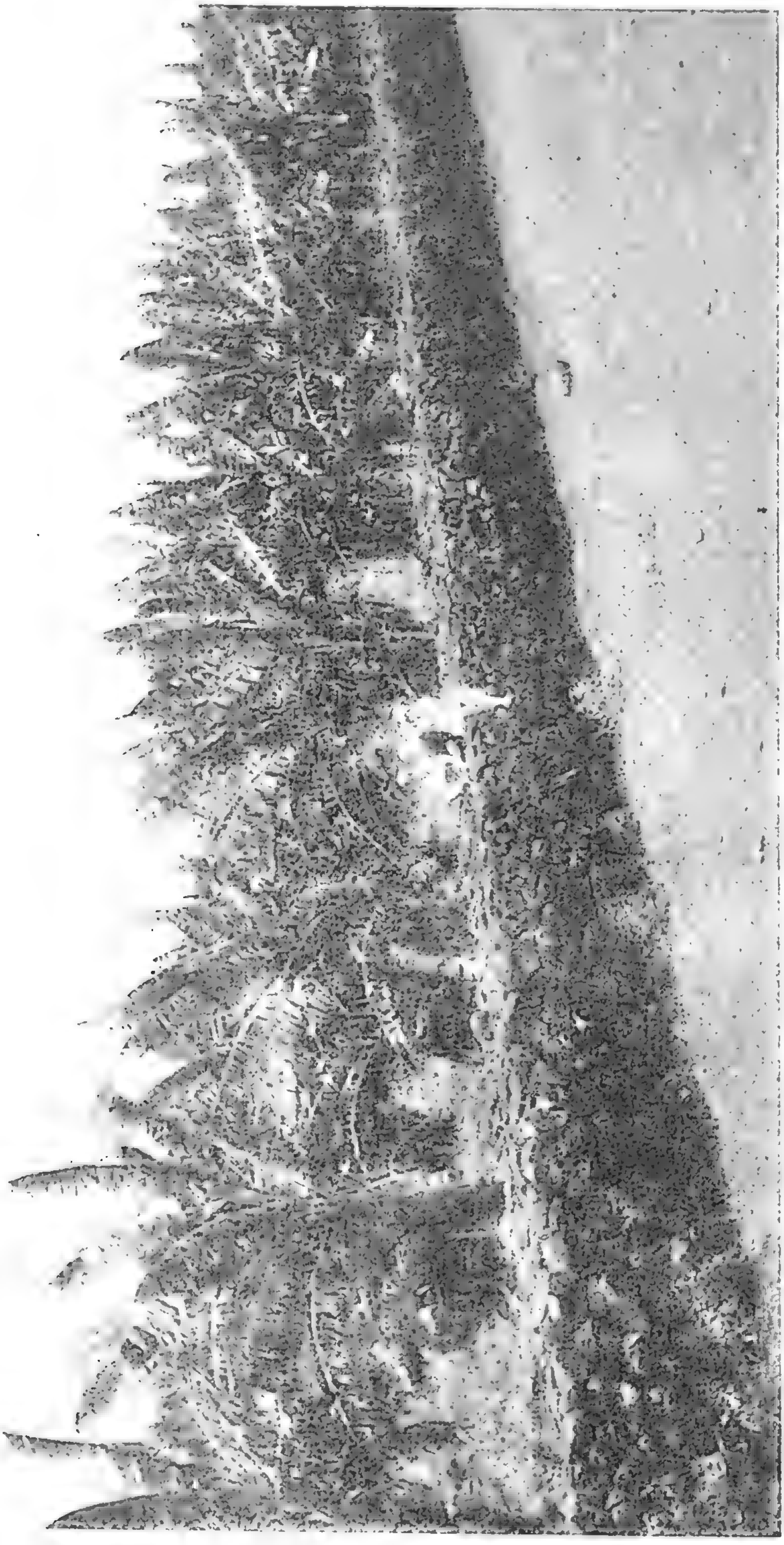

PLATE 137.
A banana plantation on Buderim Mountain, Queensland.

LIST OF LICENSED BRISBANE FARM PRODUCE AGENTS.

Addis Bros.
Allen, J.
Anderson, Edward Arthur
Archer and Goss
Arkell, W., and Sons
Australian Fruit and Produce Co.
Barnes and Co., Pty. Ltd.
Barr, Alexander S.
Barron, Orr, and Co., Pty. Ltd.
Barter, G. and W.
Bowden, T. S., and Co.
Brabant and Co.
Burns, Philp, and Co., Ltd.
Burrell, Fenton, and Co., Pty. Ltd.
Carseldine, Arthur W.
Carter, Alfred J.
Chave, Alfred E.
Clark and Jesser
Collard and Mackay
Comino Bros. Pty. Ltd.
Committee of Direction of Fruit Marketing
Cooksley, Jack Royston
Cooksley and Co.
Cooper Bros.
Cranley, J. P., Pty. Ltd.
Cripps, William
Dairy Products Co-op. Co. Ltd.
Dalgety and Co. Ltd.
Davies, W. C., and Co.
Dean, Henry, and Sons, Pty. Ltd.
Edward, George
Eriksen, Hans P.
Evans, Arthur L.
Evans, Norman
Farmers' Co-op. Distributing Association of Queensland, Ltd.
Foggitt, Jones, Pty. Ltd.
Foley Bros., Ltd.
Fong Pie and Co.
Francis, Frederick W.
Gall, George
Geeves, Hedley, Ltd.
Gesler, Frederick C.
Good, D. E.
Granite Belt and Coastal Fruit Agency
Guinsberg, Israel
Hall and Pascoe
Harris, H. N., and Co.
Hodges and Pratt
Hutton, J. C., Pty. Ltd.
Izatt and Johnson
Jacklyn and Jacklyn
Jackson, J., and Co. (Produce and Seeds), Pty. Ltd.
Johnson and Markwell, W.
Johnston, Adam
Johnston, Reginald W.
Johnston, William
Jordan, Ernest Arthur
Justins and Finlayson
Laidlaw and Co., G.
Lambert, G. and W.
Leavy, James H.
Livingstone, J. R.
Luxford, S.
Mackay, William M.
Mant, Charles O.
Martin, Duncan G.
Martin and Co.
Matthews, John
Mendoza and Wright, Pty. Ltd.
Murray Bros.
Murray, John
McCausland, Louis J.
McCook Bros.
McCowan and Hammond
McDowall, Edward
New Zealand Loan and Mercantile Agency Co., Ltd.
Nicholson, Alphonso
Pettigrew and Wilson
Plint, H. C.
Potter, W. E.
Queensland Fruit Distributors
Robinson and Laidlaw
Robsons, Ltd.
Russell, H. M., and Co., Pty. Ltd.
Scott, Garrad, and Co.
Sellars, Derek P.
Sellars, R. B.
Shay, Percy Robert
Sibley, P. C.
Siemon, W., and Sons, Pty. Ltd.
Skinner, P. J.
Spence, J. W.
Stanton Bros.
Stanton, Harry
State Produce Agency Pty. Ltd.
Stewart and Walker
Sutton Bros.
Tacey and Eyre
Thorpe, H. W.
Wanless, Thomas H.
Watson, W. P., and Co.
Whatling, E. H. R.
Wiltshire, F. C. G.
Winters, E.
Wool, A. E.
Wool, H. L.
Yow Sang and Co.

LIST OF LICENSED COUNTRY FARM PRODUCE AGENTS.

Backhouse, J. J. C., Killarney
Baker, G. H., Stanthorpe
Barben, F. J., Gladstone
Berlin, E. A., Marburg
Black, H. L., Mackay
Bramble, J. G., Rockhampton
Brand, Thomas, Mackay
Curtis, W. E., and Co., Bundaberg
Dawson Joseph, Rockhampton
Dimind, A. B., Mackay
Ellwood, E. A. Killarney
Elwing, J. A., Rockhampton

List of Licensed Country Farm Produce Agents—*continued.*

Featherstonhaugh, Albany, Roma
Foley, P. J., Mackay
Goltz, F. W., Mackay
Good, D. E., Rockhampton
Gore, Edward, and Co., Oakey
Gower, H. R., Rockhampton
Griffiths, G. H., Rockhampton
Haigh, E. V., Ipswich
Harding and Walker, Ipswich
Heers, J. W., Coominya
Jones, J. E. L., Gladstone
Joyner, R. G., Gladstone
Lee Sang and Co., Cairns
Leonard, T. J., Mackay
Leong Sun, Townsville
Limpus, Bert, Bundaberg
Limpus, C. M., and Co., Bundaberg
Lindemann, C. H. D., Lowood
Lymburner, E. A., Cairns
Mackay District Co-op. Fruit, Vegetable, Poultry, Bacon Association, Ltd., Mackay
Manz, Walter, Lowood
Mar Kong, Townsville
Maxwell, Samuel, Warwick
Melrose and Fenwick Pty. Ltd. (trading as Townsville Fruit Exchange), Townsville
Moynehan, W. J., Imbil
Olsen, A. E., Killarney
Poll and Co., Wynnum Central
Profke, Albert, Lowood
Ransome, V. W., Warwick
Reason, S. C., Warwick
Redmonds Pty. Ltd., Bundaberg
Reeds Pty. Ltd., Maryborough
Rex, J. W., Maryborough
Reye, C. A. H., Townsville
Richardson, A. N., Rockhampton
Robinson, John, Toowoomba
Stay, W. H., Toowoomba
Tatnell, W. R., Gympie
Thomas, D. B., Gympie
Thomas, George, Gympie
Thomas, L. J., Gympie
Thompson, Sydney, Warwick
Thorpe, T. E., Cairns and Townsville
Tong Sing and Co., Cairns
Tung Yep, Cairns
Turner, George Baden Powell, Bowen
Walker, E. E., Gympie
Walker, Shaw, Townsville
Walters, W. J., Lowood
Warrys Pty. Ltd., Maryborough
Waters, Punzell, and Williams, Mackay
Willie Young, Rockhampton
Wilson, John, Kingaroy
Wright, D. C., Charleville

PLATE 138.
Main street, Biloela—the centre of a progressive cotton-growing district, Queensland.

QUEENSLAND SHOW DATES, 1934.

May.

Taroom, 1st and 2nd (Camp Draft, 5th)
Dalby, 3rd and 4th
Beaudesert, 2nd and 3rd
Nanango, 3rd and 4th
Blackall, 7th to 9th
Chinchilla, 8th and 9th
Charleville, 8th to 10th
Crow's Nest, 9th and 10th
Boonah, 9th and 10th
Monto, 9th and 10th
Kingaroy, 10th and 11th
Ipswich, 15th to 18th
Miles, 16th
Kilkivan, 16th and 17th
Mitchell, 16th and 17th
Mundubbera, 16th and 17th
Dirranbandi, 16th and 17th
Wondai, 17th and 18th
Roma, 22nd to 24th
Gympie, 23rd and 24th
Emerald, 23rd and 24th
Biggenden, 24th and 25th
Murgon, 24th to 26th
Toogoolawah, 25th and 26th
Kalbar, 26th
Goomeri, 29th and 30th
Biloela: 31st May and 1st and 2nd June.
Wallumbilla: Cancelled.

June.

Maryborough, 1st, 2nd, and 4th
Marburg, 1st and 2nd
Childers, 5th and 6th
Gin Gin, 5th and 6th
Bundaberg, 7th to 9th
Lowood, 8th and 9th
Bororen and Miriam Vale, 11th and 12th
Gayndah: 13th and 14th
Wowan, 14th and 15th
Rockhampton, 19th to 23rd
Mackay, 26th to 28th
Laidley, 27th and 28th

June—*continued.*

Proserpine, 29th and 30th
Townsville Camp Draft, 30th
Mount Larcom: No Show.

July.

Bowen, 4th and 5th
Gatton, 4th and 5th
Kilcoy, 5th and 6th
Ayr, 6th and 7th
Townsville, 10th to 12th
Woodford, 12th and 13th (Sports only)
Rosewood, 13th and 14th
Cleveland, 13th and 14th
Cairns, 17th to 19th
Charters Towers, 18th and 19th
Caboolture, 20th
Nambour, 18th and 19th
Atherton, 24th and 25th
Barcaldine: 24th and 25th
Esk: 27th and 28th
Pine Rivers, 27th and 28th

August.

Royal National, 6th to 11th
Home Hill, 31st August and 1st September

September.

Enoggera, 1st
Imbil, 7th and 8th
Ingham, 7th and 8th
Pomona, 12th and 13th
Innisfail, 14th and 15th
Beenleigh, 20th and 21st
Mareeba, 20th and 21st
Rocklea, 22nd
Malanda, 26th and 27th
Kenilworth, 29th

October.

Southport: 5th
Millaa Millaa, 5th and 6th
Tully, 12th and 13th

IMPORTANCE OF MODERN DAIRY BUILDINGS.

Apart from the fact that the law imposes certain obligations on persons who erect dairy farm buildings, there are many other good reasons why these premises should be built according to well-designed plans. Among the reasons in favour of better dairy farm buildings are—They afford more protection from contamination for milk and its products. They help towards greater efficiency and economy. They are easier to maintain and to keep clean. They ensure better quality products by improving ventilation, cooling capacity and light.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Australian Illawarra Shorthorn Society and the Jersey Cattle Society, production charts for which were compiled during the month of March, 1934 (273 days period unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORN.			
	MATURE COW (OVER 5 YEARS), STANDARD 350 LB.			
Linda 8th of Kilbirnie	Macfarlane Brothers, Radford	14,335·3	562·576	Mowbray 2nd of Kilbirnie
Dot of Frenchview (257 days)	W. J. Freeman, Rosewood	11,243	436·783	Jubilee's Admiral
Foremost 2nd of Blacklands	A. Pickels, Wondai	11,505·3	422·425	Sir Hugh of Hillview
Charm II. of Bri Bri	A. E. Vohland, Aubigny	11,533·9	422·366	Gay Boy of Tyrone
Pearl 11th of Quarnlea	Lehfeldt Bros., Kalapa	10,273·49	384·912	Lord Nelson of Blacklands
Ethel 11th of Raleigh	A. Pickels, Wondai	11,052·2	362·944	Democrat of Raleigh
Biddy 5th of Railway View	H. Embrey, Rosewood	9,546	355·531	Elected of Railway View
	SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.			
Venie of Wilga Vale	C. O'Sullivan, Greenmount	12,685·46	511·939	Reliance of Blacklands
	JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.			
Madam 3rd of Cedar Grove	H. Embrey, Rosewood	8,777	370·692	Duke of Cedar Grove
Dell of Cedar Grove	H. Embrey, Rosewood	7,692·5	325·522	Mabel 2nd's Victor of Coral Grange
Blacklands Strawberry 6th (266 days)	A. M. Johnson, Gracemere	8,429·68	320·293	Governor of Blacklands
	SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.			
First 21st of Quarnlea	Lehfeldt Bros., Kalapa	11,507·78	431·621	Nugget's Lad of Hillview
Flirt of Glengallan	R. Tweed, Kandanga	9,806·1	381·017	Nobleman of Blacklands
Cedargrove Shamrock 17th (268 days)	W. J. Freeman, Rosewood	7,593	328·303	Duke of Cedar Grove

JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.				
Woodlyn Lily	J. Lyndon, Worongary	11,309·89	458·029	Spanker of Glenrock
Thelma 5th of Blacklands	A. Pickels, Wondai	7,636·6	317·774	Fussy's Monarch of Hillview
Ettie 7th of Blacklands	A. Pickels, Wondai	7,464·7	308·904	Governor of Blacklands
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.				
Trevlac Mayflower (266 days)	W. J. Freeman, Rosewood	7,657·5	311·098	Butterboy of Railway View
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.				
Navillus Myrtle	C. O'Sullivan, Greenmount	7,901·26	336·479	Midget's Sheik of Westbrook
Cedar Grove Ivy 13th	C. O'Sullivan, Greenmount	6,774·76	282·891	Duke of Cedar Grove
Miss Myrtle 2nd of Blacklands	A. Pickels, Wondai	7,757·8	259·75	Limelight of Parkview
JERSEY.				
SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.				
Flo of Rosehill	F. R. Nimmo, Rosewood	9,703·5	541·001	Raleigh's Lad of Rosehill
SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.				
Glenmah Victor's Irene	F. A. Maher, Indooroopilly	6,597·47	333·655	Retford Victor's Noble
Glenmah Victor's Matilda	F. A. Maher, Indooroopilly	6,365·57	318·223	Retford Victor's Noble
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.				
Bellegarth Princess Chime	D. R. Hutton, Cunningham	6,129	308·629	Bellefaire Blonde's Bellringer
Bellegarth Rosalie	D. R. Hutton, Cunningham	4,618·75	263·223	Bellefaire Blonde's Bellringer

Answers to Correspondents.

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. Cyril T. White, F.L.S.

Bassia Burr.

INQUIRER (Brisbane)—

The only satisfactory means we can think of for the eradication of the Bassia Burr is the ordinary one of cutting off, stacking together, and burning. If the area is a large one, possibly there is some gear on the station that can be used for the purpose. If the plants are cut off at the present time or broken down and raked together, I do not think there is any chance of the old roots shooting again. Of course care should be taken not to distribute the seeds of the plant any more than possible in the process of raking-up.

Western Grasses and Plants.

G.C.B. (Longreach)—

Astrebla pectinata, sometimes called the Upright Mitchell.

Astrebla lappacea, usually called Curly Mitchell.

Astrebla squarrosa, Bull Mitchell. As mentioned there is another variety of Mitchell, namely *Astrebla elymoides.* This is the variety which is generally called Weeping or Hoop Mitchell.

Iseilema membranacea, Flinders Grass, tall variety.

Iseilema actinostachys, Flinders Grass, dwarf variety.

Eulalia fulva, Brown Top. This grass has been very highly spoken of as a fodder in New South Wales and by some authorities in Queensland, but so far as we have observed stock do not take readily to it. Have you noticed stock eating it at all in your district?

Dactyloctenium radulans, Button Grass.

Atriplex Muelleri. This apparently is the commonest Salt Bush in most parts of Western and Central Queensland. So far as we have observed it is not eaten by stock to any great extent. Stock very often prefer these salt bushes when they are dying off rather than when they are green and luxuriant.

Acacia farnesiana, Mimosa.

Feather Top.

F.W. (Lanefield)—

The specimen is *Chloris virgata,* a grass very closely allied to the common Rhodes Grass (*Chloris Gayana*). It does not, however, seem to possess the palatability of Rhodes Grass, and where Rhodes can be grown has no advantage over it. Though a very luscious-looking grass, our experience has been that stock reject it when other feed is available. We have heard, however, that it makes excellent hay, and that in this form stock eat it readily enough. The only local name we have heard applied to the grass is Feather Top.

Guinea Grass.

H.D. (North Arm, N.C.L.)—

The grass is *Panicum maximum,* Guinea Grass. This grass was cultivated rather extensively some years ago as a fodder, but went out of favour, perhaps on the introduction of Paspalum. There is no doubt that Guinea Grass is relished by stock, and we think a small paddock, say 2 to 5 acres, of grass such as this and Blue Panic should make a great standby for dairymen. The grass is frost-tender, but this may not trouble you at North Arm. It is propagated from seed or roots, but the seed, though produced in abundance, give a low percentage of germination. To obtain the best results the grass must be either fed or cut down.

Grasses and Plants Identified.

G.L.T. (Goodwood)—

Eragrostis diandra, a Love Grass. The name Love Grass is applied in a general way to species of the genus *Eragrostis* on account of their beauty.

Erigeron linifolius, Peg Weed, also called Rag Weed, though this latter name belongs more correctly to another plant.

Acacia Cunninghamii (?), as far as can be told from the specimen. The spikes were rather young to be certain. This wattle is often called Black Wattle in Queensland.

Rhynchospora sp., a species of Sedge. Under separate cover I am posting you a book by the late F. M. Bailey which gives the distinctions between grasses and sedges.

Eragrostis australiensis (?), as far as can be told from the rather small specimen. This particular Love Grass is known as the Beach Love Grass because it commonly grows over the sand dunes.

Alloteropsis semialata, Cockatoo Grass.

Eragrostis leptostachya, Paddock Love Grass.

Aristida sp., a three-pronged Spear Grass. We cannot give you the species as the seeds were badly smutted, but the genus is a large one and the seeds are rather troublesome to stock, especially sheep, sometimes working right under the skin and sometimes even into more vital parts of the animal.

Eragrostis elongata, a Love Grass.

Eucalyptus trachyphloea, the White Bloodwood. This determination is as far as can be told from the specimen. With Eucalypts or Gum trees it is always advisable to add a note on the bark, whether rough and flaky, stringy, smooth, &c.

Themeda australis, Kangaroo Grass.

Echinochloa colona, sometimes called Wild Millet, a grass very widely spread over the warm regions of the world and very closely allied to such well-known fodders as White Panicum and Japanese Millet.

Acacia flavescens, a wattle for which we have heard no very distinctive local name. We would be very glad to have local names for any of the specimens you care to send, because common names must come from people in the bush and not from the botanist.

There is no very comprehensive work on Australian trees, flowers, and grasses of a popular nature. Most of the comprehensive ones are technical, but there are a few cheap little nature study books you could get. For the wildflower study of your locality the best little book I think would be "Flowers of Our Bush," by Mrs. L. Thomson, price 2s. 6d. For grasses the best book would be "Grasses and Fodder Plants of New South Wales," by E. Breakwell, price 6s. Although this deals with New South Wales, most of the grasses mentioned occur in Queensland. A work recently issued, containing illustrations and descriptions of over 200 different sorts of orchids, ground and epiphyte, is "Gems of the Bush," Sun Nature Study Book No. 5, price 6d. For general botany you would find "The Story of Our Plants," by Miss C. le Plastrier, price 2s., a useful little work. A book on weeds is "Weeds and Poisonous Plants of Queensland," by F. M. Bailey, price 4s., obtainable from this office.

Caustic Creeper.

J.S. (Whetstone, S.W. Line)—

The specimen is the Caustic Creeper, *Euphorbia Drummondii*, a plant very common in Queensland and very widely distributed through New South Wales and the Northern Territory. It is generally regarded as poisonous to stock, though reports about it are conflicting. So far as we have seen, ordinary paddock stock seem to browse among the plant and eat it with impunity. Travelling stock, however, particularly sheep, are often badly affected by it. In New South Wales it has been found that the plant possesses a prussic-acid yielding glucoside, but repeated tests with Queensland material have always given negative results, and the symptoms described by Queensland sheepmen are certainly not those of prussic-acid poisoning. The symptoms are that the head and neck swell to an enormous size, and if the swelling be pierced an amber-coloured fluid runs out. The skin shrivels and the face of the sheep looks as if it had been badly burned, but its life is generally saved. There is no cure definitely known for the after effects of eating the plant.

Daisy Burr.

H.H.W. (Gladstone)—

The specimen is Daisy Burr, *Calotis scapigera,* a plant with a fairly wide distribution in Queensland, but most abundant on the Darling Downs. It has probably been introduced into your district with travelling stock, most probably sheep. The plant has possibilities of becoming a bad weed, and as the patch is only small it would be best destroyed by hand-cutting, raking together, and burning; or if you prefer you can give it a covering of strong salt, such as waste butcher's salt. This should be applied in dry weather, and the first heavy rains would probably wash it out of the ground.

Balsam Pear.

H.A.J. (Maryborough)—

The specimen is *Momordica charantia,* a plant of the Cucumber family, sometimes known as the Balsam Pear. It is a native of tropical Asia and Africa, and is much cultivated in warm countries as an ornamental vine. One sometimes sees this plant about Chinese gardens, and many Chinese eat the red pulpy stuff surrounding the seeds and eat the fruit boiled, generally before it is ripe. The Indians also use it a good deal in their curries. We have had no experience of the fruit ourselves as we are rather chary of these Cucurbitaceous plants, but we think, in this case, the fruit has to be soaked in water for some time before cooking to rid it of a somewhat bitter flavour. If you want to try it our advice is to cook and taste it discreetly.

White Millet.

R.S.McK. (Mungallala)—

The specimen is *Echinochloa colona,* a native grass with a very wide distribution over the warmer regions of the world. It is sometimes called White Millet, and is very closely allied to such well-known cultivated fodders as Japanese Millet and White Panicum. It is an excellent fodder grass and worth encouraging. The type of country you describe it as growing in is rather unusual for, as a rule, the grass prefers rather a damp situation, though it is not confined to such. It may often be seen as a weed in cultivation round cultivation headlands, &c.—in fact, anywhere where the ground has been disturbed.

Rattlepods.

J.M.N. (Caboolture)—

The specimen is obviously a legume, but bore neither flowers nor pods. It is a stranger to us, but we think it is *Crotalaria acicularis,* a species of Rattlepod, a very common weed in Java and the Philippine Islands. You have probably introduced it accidentally with some of your recent collections. Rattlepods are rather dangerous plants, as several of them, both in Australia and abroad, have been definitely proved by feeding tests to be poisonous to stock. So far as we have observed, however, stock generally avoid them. We would like a specimen with flowers and pods to verify the determination.

Green Cestrum, a Poisonous Plant.

R.C.B. (Chinchilla)—

Cestrum parqui, the Green Cestrum. A very poisonous plant which has been responsible for a good deal of trouble in parts of Queensland. It is not a native, but has either become accidentally introduced or is a stray from garden culture. It is a native of Chili and the Argentine, South America.

Creeping Salt Bush.

A.G. (Springsure)—

The specimen is *Atriplex semibaccata,* the Creeping Salt Bush, also frequently known as Salt Weed. It is one of the most valuable and palatable of the Salt Bushes and worthy of every encouragement. It grows naturally in parts of New South Wales and Queensland, in this State being most abundant, we think, in the Western Downs and Maranoa districts, but we have not had specimens from the neighbourhood of Rolleston before.

Weed in Oat Field—Scented Top.

G. (Hivesville, via Murgon)—

The heavy seed grass, a weed in Oats, is *Lolium temulentum*, a Darnel. This is an annual species of *Lolium* occurring mostly as a farm weed, and has very little value as a fodder. It is eaten in its young stages, but soon becomes unpalatable. The seeds are poisonous, but so far we have never come across any cases of stock-poisoning by them in Queensland, though it is a moderately common weed, particularly on the Darling Downs.

The grass with the light seed head is *Capillipedium parviflorum*, sometimes called Scented Top, owing to the peculiar scent of the seed heads when crushed. This grass is quite common in much of the forest country in coastal and sub-coastal Queensland, and is quite a good fodder. It is closely allied to the Blue Grasses.

Grasses Identified.

J.C. (Kidston, N.Q.).

Arundinella setosa, a grass fairly common in the forest country of Queensland, but of only secondary value as a fodder. We have not heard a local name applied to it.

Eragrostis elongata, Love Grass, is a name applied to several species of the genus *Eragrostis*. They are quite good grasses in the average native mixed pasture.

Heteropogon contortus, Spear Grass. Although the spears of this grass are very troublesome, particularly to sheep, nevertheless, especially in the young stages, it seems to be readily eaten by stock, and when mixed with more palatable food we have known it to make quite good chop-chop or chaff for horses and other stock.

Eriachne sp. There are several species of the genus Eriachne in Queensland. We have not heard a local name applied to the particular one you send.

Chloris ruderalis, a species of Star Grass, closely allied to the common Rhodes Grass (*Chloris Gayana*).

Polycarpæa spirostyles. This plant is commonly known as Copper Plant, for it is supposed to be an indication of copper. It is not a grass, but belongs to the family *Caryophyllaceæ*, which contains the Carnation, Dianthus, and some other common garden flowers.

In sending specimens for determination the usual practice is to number each specimen and retain a duplicate similarly numbered, when names corresponding to numbers will be forwarded.

Tape Vine.

W.D.C. (Wamuran)—

The specimen of vine is *Stephania hernandiæfolia*, known by the rather misleading name of Tape Vine. This vine has been repeatedly received at the Department of Agriculture and Stock as one suspected of being poisonous, and a number of years ago the late Dr. T. L. Bancroft found the roots to contain an exceedingly poisonous alkaloid which has since been found to extend to all parts of the plant. The plant is a very common climber on the edge of scrubs, and as it often creeps among grass, especially between rocks and stones, it is frequently eaten by stock, particularly cattle, with fatal results.

Lemon Grass.

J.M.F. (Dimbulah)—

The specimen is *Elionurus citreus*, commonly known as Lemon Grass. It is fairly abundant in parts of North Queensland and extends as far south as Moreton Bay, though it is comparatively rare in the more Southern parts of the State. It is unpalatable to stock, no doubt on account of its very markedly citron or lemon odour. The grass could probably be made more attractive to horses by mixing it with some other fodder that would mask the peculiar lemon flavour, though even then we are rather inclined to think that the horses would nose the Lemon Grass out of the way as far as possible. If you have a big stock of this grass and do not want to waste it, you would be well advised to try your mixture on a small scale instead of spoiling a lot of otherwise good fodder by mixing it with the Lemon Grass.

Japanese Clover.

G.W.C. (Kybong, via Gympie)—

The specimen of Japanese Clover (*Lespedeza striata*) has come safely to hand. We have had a great number of specimens of this plant from the North Coast, but more especially from the neighbourhood of Kilcoy and Woodford. Some residents claim that it has been there for years, but this is the first year we have noticed it; and it seems to be spreading to a very great extent. It is undoubtedly a valuable fodder plant and cattle seem fond of it, but it has the disadvantage of being a summer-growing legume and is inclined to smother out the grass. That has been the experience in some localities this season, but of course in more normal ones the plant may not be so vigorous.

Grasses—Crow Foot, Summer, Johnston.

L.B.S.R. (Mirriwinni, N.Q.)—

(1) Star Grass, *Eleusine indica,* Crow Foot Grass. This species is widely spread over the warmer regions of the world, and is mostly found as a weed of cultivation and waste places. It is quite palatable to stock, but contains a prussic-acid-yielding glucoside. Stock should be pastured on it, therefore, with a certain amount of care.

(2) Summer Grass, *Digitaria marginata,* a grass widely spread over the warmer regions of the world. Like the Crow Foot, it mostly occurs as a weed of cultivation rather than as a grass of the general pasture. It is quite a palatable grass, but dies off on the approach of the winter months.

(3) Johnston Grass or Johnston River Grass, *Paspalum conjugatum,* a common tropical grass. In parts of the Atherton Tableland it is known as "Sour Grass" or "Yellow Grass," and is said to ruin the common paspalum pastures and to have very little value either as a stockraising or dairying grass. The grass is very common as a cover in coconut and rubber plantations in New Guinea, and in such places we have seen working mules do quite well on it when it was almost their sole fodder.

Ferns and Crotons.

Mrs. P. (Eight-mile Plains)—The two specimens are—

(1) *Adiantum Whitei,* Maidenhair. Described since the publication of the lithograms.

(2) *Doodia caudata.* In "Ferns of Queensland," this species is recorded as a variety of a larger species, namely *Doodia aspera,* but has now been recorded as quite a distinct plant.

The plants mentioned by you as Climbing Maidenhair, Rock Fern, Hare's Foot, Elk-horns, Stag-horns, &c., are all true ferns.

Crotons are very easily struck from cuttings, but the time you will be receiving them (July) will be about the worst time of the year to do this work. We have grown a number of crotons and have been successful in striking them as late as the beginning of the first week in April, but this all depends on the weather. They really strike best from November to early January, requiring plenty of heat for root development. They strike well in either light sandy soil or in soil in which there is a fair percentage of gravelly creek sand. We have also been successful by using a fair proportion of furnace or boiler clinkers in the soil. If you try to strike them about July, you will have some difficulty without heat, although if you have a well protected sunny place, particularly if you have a little glass, you should be successful.

Barley Grass or Native Millet.

F.B. (Brisbane)—

The specimen of grass is *Panicum decompositum,* commonly known in Western Queensland as Barley Grass or Native Millet, although both these names, like many other local ones in Western Queensland, are rather loosely applied to a number of grasses. This particular *Panicum* is generally regarded as an exceptionally good fodder, relished by stock, and nutritious. So far as we have observed, however, it seems to grow best in damp situations, or in a particularly good season.

Grasses Identified.

W.D. (Goondiwindi)—Your specimens have been determined as follows:—

(1) *Astrebla lappacea*, Curly Mitchell Grass. This is the commonest species of Mitchell Grass in Queensland, and I think the best.

(2) *Astrebla elymoides*, commonly known as Weeping or Hoop Mitchell.

(3) *Thellungia advena*. I was very glad to get the local name "Coolibar" for this, also notes on its fodder value. It is certainly anything but a tempting looking grass, though stockowners elsewhere have told me that it is quite good feed. This grass is very common in Queensland and New South Wales, but in the past was confused with another species, the Rat's Tail Grass (*Sporobolus elongatus*). It was first named in comparatively recent years from specimens found growing in a woollen mill dump in Switzerland, and its native country was not known.

(4) *Dichanthium sericeum.*

(5) *Iseilema actinostachys*, Flinders Grass.

(6) *Panicum prolutum*. In New South Wales this grass is generally known as Coolah Grass.

(7) *Chloris ventricosa*, a species of Star Grass.

(8) *Eriochloa* sp., sometimes called Early Spring Grass. These grasses are all relished by stock. The genus is under revision at the present time at the Royal Botanic Gardens, Kew, therefore we cannot give you the specific name for it.

(9) *Chloris acicularis.*

S.L. (Tingoora)—

(1) *Chloris divaricata*, a species of Star Grass.

(2) *Sorghum leiocladium*, a native Sorghum.

(3) *Stipa setacea*, a species of Spear Grass.

(4) *Dichanthium sericeum*, Blue Grass. Generally regarded as one of the best of the native grasses.

(5) *Chloris ventricosa*, a species of Star Grass.

(6) *Themeda australis*, Kangaroo Grass. A valuable native grass, though it tends to disappear under heavy stocking.

(7) A mixture of *Panicum queenslandicum* and *Poa cæspitosa* var. *australis.*

(8) *Poa cæspitosa* var. *australis.*

(9) *Amphilophis decipiens*, Bitter or Pitted Blue Grass, generally regarded as a very inferior grass. Unfortunately, owing to the eating out of the better species in many native pastures, it has become quite dominant.

(10) *Eriochloa* sp., sometimes called Early Spring Grass. Quite a good fodder.

(11) *Poa* sp. Could you send complete material of the grass, including roots?

(12) *Eragrostis cilianensis*, Stink Grass. A rather ornamental grass, but so far as I have observed left untouched by stock. I have heard on good authority on one occasion, however, that horses took very readily to it.

Pigweeds.

D. (Townsville)—

The specimens have been determined as follows:—The small red Pigweed, *Portulacca digyna;* the larger and more upright Pigweed, *Portulacca filifolia.*

The Pigweeds are very abundant plants scattered over the warmer regions of the world. The two particular ones forwarded from near Boulia are both natives of Western Queensland and the Northern Territory. They are not known to be poisonous or harmful in any way, and the family as a whole is regarded as quite a wholesome one. Many of the Pigweeds, both in Australia and abroad, are eaten either cooked or raw as a vegetable. Like other fleshy plants, of course, they will cause hoven or bloat in stock, particularly hungry stock that are pastured on them on an empty stomach. Deaths may ensue, but this is more mechanical than toxic.

Caustic Creeper.

H.M.T. (Lochnagar)—

The Caustic Creeper, *Euphorbia Drummondii*, is looked on as a very poisonous plant both in Queensland and New South Wales. Examination of the New South Wales samples has repeatedly given positive results for the presence of a prussic-acid yielding glucoside, but examination of Queensland plants has always given negative or, at least, doubtful results.

The symptoms of Euphorbia poisoning as given by experienced stockmen in Queensland are certainly not those of prussic-acid poisoning. Prussic-acid poisoning is extremely rapid and, generally speaking, there are no outward symptoms. The chief characteristic of affected animals as observed in Queensland is a swelling of the neck and head. If this swelling is pierced an amber-coloured fluid exudes and the life of the sheep may be saved, though the face and head have the appearance of having been badly scorched.

The Caustic Creeper has a very wide range in Australia, proceeding in through Central Australia to parts of Western Australia, and in the last-mentioned State, Dr. D. A. Herbert, when Government Botanist there, carried out feeding tests on rats and produced the characteristic swelling symptoms recorded by experienced stockmen in larger animals here. Regarding the periods of toxicity of the plant, little on this point is known; but if the prussic-acid yielding glucoside is present the plant would probably be at its worst in the first cold weather after late summer rains. Regarding its growth, it is most abundant in the summer months but lasts right through the winter, and I have frequently seen plants growing in August and September.

Queensland Wattle in France.

L.P.H. (Brisbane)—

The common Wattle cultivated in the South of France for the English and Continental cut-flower trade is mostly *Acacia Baileyana.* This particular species, though it commemorates F. M. Bailey, is not grown to any extent in Queensland, except in the colder parts of the State about Warwick and the Granite Belt. In the Continental and English trade it is almost universally known as Mimosa. All the acacias, of course, are wattles, and the genus is very closely allied to the tree Mimosa botanically. According to an article in the "Gardeners' Chronicle" a couple of years ago, *Acacia podalyriæfolia*, our common Silver Wattle of Queensland, had been introduced to the South of France, and limited supplies of it were finding their way to London. The common Golden Wattle of the Brisbane district is *Acacia fimbriata.* So far as we know this last species is not cultivated in Southern Europe.

General Notes.

Staff Changes and Appointments.

Mr. James Purcell (Toowoomba) has been appointed Chairman of the Dairy Products Stabilisation Board until the 7th February, 1935.

Constable W. J. Huey (Millaa Millaa) has been appointed also an Inspector under the Slaughtering Act.

Constable W. Robinson, Officer in Charge of Police at Nebo, has been appointed also an Inspector under the Brands Acts.

Mr. J. R. Canty, Slaughtering Inspector at Innisfail, has been appointed an Inspector under the Apiaries Act.

Mr. M. A. Hannigan (Kyoomba, via Stanthorpe) has been appointed an Inspector on probation under *"The Diseases in Plants Acts,* 1929 *to* 1930," and Agent under *"The Banana Industry Protection Act of* 1929," Department of Agriculture and Stock.

Messrs F. C. Jorss, R. J. Rollston, and N. Lambert have been appointed Assistant Inspecting Cane Testers for the 1934 Sugar Season, and will be stationed at Cairns, Mackay, and Bundaberg, respectively.

Mr. I. H. Simon, Customs Officer, Maryborough, has been appointed an Inspector under the Diseases in Plants Acts, and the Apiaries Act.

The Honey Board.

An Order in Council issued under the Primary Producers' Organisation and Marketing Acts formally extends the operations of the Honey Board for the period from 9th March, 1934, until 8th March, 1939. Notice of intention to make this Order in Council was issued in January last, and a petition for a ballot on the question of the continuance or otherwise of the Pool was invited from growers, such to be lodged before 5th February last. A petition was received, and a ballot conducted, which favoured the continuance of the Pool.

Regulations have been approved under the Primary Producers' Organisation and Marketing Acts, empowering the Honey Board to levy on growers of honey and beeswax at the rate of 1½ per cent. on all honey and beeswax sold during the period from 1st April, 1934, to the 31st March, 1936, to provide for the administrative expenses of the Board. The amount of the levy shall be deducted from the proceeds of sales of honey and beeswax by agents and persons who purchase honey and beeswax from a grower, or sells these commodities on account of a grower, and the amount collected shall be forwarded to the secretary of the Honey Board not later than the seventh of the month next succeeding such purchase or sale.

On the 22nd August, 1929, approval was given for the exemptions of sales of honey by beekeepers direct to local consumers or to retail vendors in such beekeepers' district, subject to certain conditions. This action was taken pursuant to the provisions of Section 15 (4) of the Primary Producers' Organisation and Marketing Acts, which provides that the Board may in such cases and in such terms and conditions as may be prescribed by the Minister, exempt certain growers and certain of the commodity subject to the Act. The Honey Board has requested that this notice be cancelled, and approval has accordingly been given to the cancellation of the notice in question.

Honey—Places of Entry.

In pursuance of the provisions of Regulation No. 1 of the Regulations under the Apiaries Act, the Minister for Agriculture and Stock (Hon. Frank W. Bulcock) has named Innisfail and Clapham Junction as places of entry for the introduction into Queensland of bees, honey, and beekeeper's appliances.

"A B C of Queensland and Australian Statistics."

A copy of the 1934 issue of the "A B C of Queensland and Australian Statistics" has been forwarded to us by the Registrar-General (Mr. G. Porter).

This useful booklet is to all intents and purposes the Official Year Book of Queensland, and is presented under the authority of the State Government. The 1934 edition contains, in addition to the main features appearing in the 1933 issue, information relating to—(*a*) The results of sales held at the Brisbane Wool Market for the last ten years, and (*b*) the disposals of butter and cheese made in Queensland for the last five years.

The rates of taxation in Queensland and other States have been revised in accordance with amending legislation; the main points of the Main Roads Regulations and the Heavy Vehicle Regulations are revised, and points of "*The State Transport Act of* 1932" have been included.

Populations have been revised in accordance with the Census of 30th June, 1933, and per capita figures on ten-yearly tables, &c., have been adjusted.

Information concerning many phases of Production—Primary and Secondary—Finance, Labour, and Industrial matters, Vital Statistics, &c., is included.

Population.—The population of Queensland at the Census date, 30th June, 1933, was 947,789, and at the 31st December, 1933, 949,286.

Queensland's crude birth rate of 18.56 per thousand of population is the second highest in Australia, whilst the crude death rate—8.35 per thousand—was the second lowest in Australia and third lowest in the world. Only New Zealand and South Australia record lower rates of infant mortality.

Trade.—The value of Imports for 1932-33 in Australian Currency was £5,660,772, and the Exports £15,279,726, the excess of Exports being £9,618,954. The Imports and Exports per head of population were £6 0s. 4d. and £16 4s. 10d. respectively.

Finance.—The Public Debt of Queensland at 30th June, 1933, was £114,530,855—£120 16s. 10d. per capita of population. The total amount of Taxation per capita was £6 0s. 4d., New South Wales and the Commonwealth Taxation being higher.

Motor and Wireless Licenses.—At the 31st December, 1933, there were 91,435 Motor Vehicles registered, and 40,771 Wireless Listeners' Licenses were in force.

Unemployment.—For the last quarter of 1933 Queensland's percentage of unemployment—13.8—was well below that of any other State; the figure for the Commonwealth was 23.0.

Livestock.—At 1st January, 1933, there were 5,535,065 Cattle, 21,312,865 Sheep, 452,486 Horses, and 213,249 Pigs.

The Wool production of 1932-33 amounted to 185,833,546 lb. (greasy), and was valued at £6,976,501.

Agriculture and Dairying.—In 1932 the Wheat Crop amounted to 2,493,902 bushels; Maize, 1,653,853 bushels; Sugar made, 514,027 tons; Cotton (unginned), 6,270,116 lb.; Tobacco, 2,303,861 lb.; the Butter made amounted to 96,317,201 lb.

Mineral Production.—The total Mineral production was valued at £1,784,499 for 1932, including Coal, £684,555; Lead, £573,813; Silver, £182,733; and Copper, £108,858.

Value of Production.—The recorded production from all Queensland Industries in 1932-33 was valued at £47,056,142, or £50 1s. 10d. per capita of population, Primary providing £35 1s. 7d. per capita, and Manufacturing £15 0s. 3d.

These are but a few of the interesting features of the "A B C" which is now available at a nominal cost of 2s. (posted 2s. 3d.). Copies may be had upon application at the Registrar-General's Office, Treasury Buildings, Brisbane.

Regulation under Sugar Experiment Stations Acts.

A regulation under the Sugar Experiment Stations Acts has been issued which provides that the Secretary of a Cane Pest Board shall maintain at his office a register of all transactions relative to moneys due to the Board in respect of fumigants or labour supplied by the Board for the suppression of cane pests. Such register shall be open for inspection upon the payment of one shilling.

It will now be possible for any interested person to learn from the Local Cane Pest Board whether that Board had a first charge over the assets of any particular cane farmer in respect in fumigants, &c., supplied.

Rural Topics.

Chilled Beef—Opportunity for Farmers.

The recent meeting in Sydney of beef exporters and shipping representatives suggests that definite progress is being made towards the establishment, on something more than an experimental footing, of a chilled beef trade with Britain.

Technical research and actual experience both suggest that the successful establishment of the trade in New South Wales is now largely a matter of organisation. Progress will depend, however, upon the active co-operation of all those directly interested. Recognising this, exporters and shipowners have taken the initiative, and it now devolves upon the producers as a body to follow the lead thus given them.

It has been stated, in quarters not lightly to be disregarded, that a successful chilled beef trade will be impossible until a constant supply is available of cattle bred and grown to meet the special requirements of the trade. Eventually, this will become true, but meantime, fortunately for the industry, there is authority, no less trustworthy, for the definite statement that here are now in Australia ample supplies of suitable stock to warrant the commencement of commercial exports as soon as the necessary meatworks and shipping arrangements can be made. In the early stages, large shipments, even if possible, would be unwise. A demand for Australian chilled beef must first be cultivated. And, by the time an extensive demand has been created, the producers will have had an opportunity to prepare to meet it.

Since the South Americans established their practical monopoly of the most valuable section of the British market—the household supply—consumers' requirement have changed radically. Large, fat joints, such as come from big bullocks five years old and upwards, are no longer acceptable to the British housewife, who demands young beef of prime quality. The South Americans have not only met, they have actively encouraged this change in taste, because it still further increased the advantages given them by the chilling process. Australian producers, on the other hand, have not been able to keep fully abreast of these changes for the good reason that, while they remained dependent upon hard freezing, to do so was impossible economically, if not technically.

These and other barriers to progress are now, however, about to be removed, and with the help of Australia's natural advantages as a beef-producing country—and of the Ottawa meat agreements—it will be possible to meet the foreigner on level terms and beat him at his own game. To achieve this, extensive reorganisation of the methods of production will be necessary. The higher comparative prices which may confidently be expected for a higher grade product will, however, justify a considerable degree of specialisation, such as is practised in South America, and the breeding, growing, and fattening of beef for export, either as separate, specialised branches, or in combination, will again become profitable.

To secure the fullest measure of success, the producers must be guided by three principal aims: The breeding of early maturing stock of best beef type; the development of a system of feeding which will ensure unchecked progress and bring the beast to killing condition carrying a high degree of finish at between two years and three years of age, and last, but not least, continuity of supply. The first of these objectives requires no comment. Once breeders are assured of a return on their outlay in raising the standard of their herds they can be trusted not to "let the grass grow under their feet." The third objective, especially in this country, is so intimately identified with the second that separate consideration is unnecessary.

It is upon the second objective—the development of a scientific system of feeding—that the eventual success or failure of the industry depends. To attain it a great deal of work will be necessary, but in the process large numbers of farmers will find an opportunity to employ profitably suitable land at present too valuable for grazing, and otherwise not fully productive. Any successful system of feeding cattle intended for chilling will require the provision of improved natural or introduced pasturage, and, in most cases, of suitable fodder crops. Fodder conservation will also play an important part in the system, which must ensure throughout the year adequate supplies of feeding constituting a "balanced ration" designed for beef production. This is work which, in many cases, the man occupying a small area of good land in a district with a good rainfall will be able to undertake more effectively and more economically than the big grazier.

Details will vary in different States, and even in different districts, because of climatic and other factors, but, broadly speaking, these are the basic principles upon which the successful beef raising of the future must be founded. They are well within the capacity of the enterprising grazier and farmer to attain. The rewards they promise are sufficiently attractive to justify immediate action, so that the production of beef of the best possible quality may proceed progressively and contemporaneously with the exploitation of the chilling process and the cultivation of a market demand for beef "produced in Australia."—L.G.A., in the "Sydney Morning Herald."

Horse-breeding—The Choice of a Sire.

In the breeding of horses there is nothing more important than care in the choice of the sire. A definite ideal must be in the breeder's mind in relation to type. Pedigree is an essential, and purity of lineage cannot be too strictly insisted upon. The next inquiry must be for a sire possessing freedom from hereditary disease determined as the result of an examination by a veterinary surgeon. The main object of the breeder is to secure strength, and at the same time the staying power that enables a horse to do a hard day's work for a lengthened period.

The sire must be active, intelligent, and tractable, though full of determination. Beyond all dispute the best evidence of a horse's staying power and length of service in the heavy breeds is balanced action—the movement and stride that enables a horse to cover the most ground with a maximum of ease and a minimum of friction and wear. True action has a special value in both sire and mare, for where the feet are raised and placed in precise and regular form in walking and trotting, there is resistance to bone and joint troubles, and there is also lengthened service. An evenly balanced body would lose its value on ill-shaped feet, or abnormally dropped legs.

Constitution and stamina are also needed to withstand the stress of continuous work. The indications of a general nature must include a good barrel or middle piece, showing ample space for digestion, and vigorous heart and lung action. A slack-loined horse is more or less "soft," and a tucked-up barrel, sometimes termed "herring-gutted," also betokens lack of stamina. Ample girth, depth through the lines, and fulness at the flank all favour constitution.

It is not an uncommon thing to see a "washy" horse which is big in the barrel, but which with stress of work soon falls away in condition and exposes his true type with a lightness about the girth and loin. A fleshy heavy head should not be favoured; while, on the other hand, a lean head, wide in the cheek, with a good space between the branches of the lower jaw, denotes constitution, as also does the bright, lively eye and quickly-moving forward ears.

Weight and substance with a good top and quality of feather are required. The condition of the skin must be closely examined.

A good temper and kind disposition invariably accompany intelligence and good manners.

An examination of the legs, for durability, must not be overlooked, and should result in the discovery of clean, flat bone, with tendons distinct, free and clear from the bone. Sloping pasterns of medium length are desirable. The closest scrutiny should be made of the structure of the foot—a firm wide heel, strong horny crust, healthy frog, and level placing must be shown.

A general overhaul of the animal in the actions of walking and trotting affords the opportunity of estimating his character, and many features that it is impossible to outline also aid in arriving at fairly sound conclusions. A prominent breeder states that "we should not select as a result of the animals possessing some specially good quality, but rather select him from the absence of faults and the general accumulation of harmonious and worthy qualities in disposition, conformation, and stamina." The exaggerated development of any single meritorious point is not compensation for some flagrant deficiency.

Performances or exhibition in the show ring do not always afford the most reliable evidence of a sire's capacity for leaving sound stock, but these, in conjunction with the proved excellence of his stock, are the best guarantees to owners of mares. The knowledge of pedigree, stoutness, prepotency, quality, weight, action, and other desirable qualifications is thus eclipsed in guiding the breeder by absolute evidence of the very best kind.—A. and P. Notes, N.S.W. Department of Agriculture.

Protein for Milk Production.

In his report on the competition recently conducted by Camden Haven branch in regard to feeding cows for production, Mr. E. O. Dalgleish, Senior Dairy Instructor, emphasised the value of protein.

The protein or nitrogenous portion of any fodder mixture is the most expensive one to provide, but it has been very truly said that the secret of milk production lies in the provision of a plentiful supply of protein. Common fodders rich in protein are lucerne, cowpeas, and vetches, and among the concentrated fodders, linseed meal.

"Balancing" a ration means that the foods are to be mixed in such a way that all the constituents thereof can be most economically made use of by the cow. For instance, saccaline contains a large proportion of carbohydrates—sugar. If fed on a ration of saccaline only, the cow will use only such proportion of the carbohydrates as she requires, and the remainder is wasted. To "balance" the carbohydrates, a fodder containing more protein should be mixed with the saccaline, and the quantity of the latter reduced. A suitable fodder would be lucerne hay. Substitutes, however, could be cowpeas, vetches, red and berseem clovers. A crop which is very high in protein and which has not been tried in New South Wales to any extent is the soya bean, a crop which is grown very extensively in the United States.

The cow's natural fodder, and one which naturally provides a balanced ration, is a mixture of grasses and clovers in bloom, and if this could be provided for her all the year round would be easily the most economical method of feeding. A start in the right direction is the provision on most of the farms of areas of winter grasses and clovers. If continued and extended into a number of small paddocks on each farm these will be of incalculable benefit in time to come, when it may be possible for paspalum and clover pastures to provide grazing in the summer, with rye and clover pastures for the winter—reserves in case of necessity being provided by the pit silo.

A Useful Lick for Dairy Cattle.

Where the dairy farmer has reason to suppose that his cows are suffering from a mineral deficiency in their diet, commonly indicated by the habit of bone-chewing, he should lose no time in correcting the condition. In the case of hand-fed cows, the addition of two or three tablespoonsful of sterilised bone-meal to the feed daily will be found highly beneficial. Where the cattle are not hand-fed, a lick should be provided in troughs in the paddocks or in boxes in the milking sheds or feed stalls. This lick may be simply sterilised bone-meal itself, or if it is desired to provide the animals with other ingredients as well, including salt, the following mixture will be found of value:—

Salt	40 parts.
Sulphate of iron	1 part.
Bone-meal	10-40 parts according to the requirements of the cattle.

Soil Erosion.—A Cause of Enormous Loss.

From every conceivable angle erosion is a devastating agency. It is the greatest thief of soil fertility. It steals not only the plantfood contained in the soil, but the whole body of the soil, plantfood and all. When this productive material that required centuries in the building is washed out of fields it cannot be economically hauled back, even where it is washed no farther than from the upper to the lower slopes of fields. That which passes down into the beds of streams and on out to the ocean is lost as irretrievably as if consumed by fire. It has been estimated that erosion steals twenty-one times as much plantfood as crops take out of the land.

Surveys and soil-loss measurements indicate that at least 3,000,000,000 tons of soil are washed out of the fields and pastures of the United States every year. The value of the plantfood contained in this amounts to more than two billion dollars, on the basis of the cheapest fertilizers. Of this almost inconceivable wastage, the direct loss to the farmers of the United States of America is not less than 400,000,000 dollars every year. This is paid for in reduced acreage yields, increased cost of cultivation, fertilization, and the growing of crops for the sole purpose of building up impoverished fields, in land abandoned, highways damaged, reservoirs, irrigation ditches, and culverts choked with erosional debris, and accumulative thinning of the surface soil, the staggering cost of which is postponed until the last inch of soil is washed off.

Pig Raising.—Suitable Crops and Feeds.

Lucerne, either for grazing or for cutting and feeding in the sty, is the best green feed for the boar, sows, and young pigs. Wheat, oats, rye, and broadcast maize are also very suitable as green feeds for grazing; climbing varieties of cowpeas can be sown among the maize.

Sorghum should be fed only when mature. Rape is a fine winter crop, ranking next to lucerne for grazing purposes. Jerusalem artichokes are very hardy, and grow well in light soils. The pigs should be turned in to harvest these after the plants have flowered.

Sweet potatoes, suitable for warm districts of good rainfall, are good for pigs when fed with a small percentage of maize or other grains and skim-milk; they are utilised in the same manner as artichokes for grazing. Sugar beet and mangolds are excellent feed fed raw, and can be readily stored in a pit. Potatoes should be boiled and fed with skim-milk or maize; the water in which the potatoes have been boiled should not be given to the pigs.

Pumpkins can be largely grown; they should be fed raw. Wheat and barley should be crushed and steamed for a few hours and fed with skim-milk or whey.

With regard to mill refuse (pollard, bran, and sweepings), the market value of these determines whether it pays to feed on them or not, but a very little pollard mixed in milk keeps pigs growing and fattening well. Bran, which is properly rather a laxative than a pig food, is very useful for brood sows. Sweepings from mills, &c., should be used carefully, as they often contain a lot of rubbish. It is wise to soak the sweepings, so that any nails, nuts off bolts, or similar dangerous foreign objects may sink and be separated.

Skim-milk, butter-milk, and whey are widely used as food for pigs. Skim-milk, which should be fed with crushed grains or pollard, is a good flesh-producing food. It should not be used straight from the separator, but allowed to stand an hour or so, so that the gas may work out of it. When feeding butter-milk, always add pollard or crushed wheat, barley, or maize; otherwise the pigs will be soft and blubbery when dressed. Whey also should only be fed when mixed with crushed grains.

To avoid any chance of tuberculosis, all milk products should be boiled before being fed to the pigs.

Following is a table of crops (mostly green feeds) suitable to grow as food for pigs:—

PLANTING TABLE OF CROPS SUITABLE FOR THE PIG-RAISER.

Crop.	When to Sow.	When Available.
Barley	February to April ..	May to October
Rye	ditto	June to September
Oats	ditto	June to November
Rape	ditto	June to September
Kale	ditto	August to October
Cowpeas	September to November	January to April
Pumpkins	ditto	January to June
Maize	October to December ..	January to April
Feed Millets	ditto	December to April
Sorghum	ditto	December to May
Turnips	February to April ..	May to October
Artichokes	September to October ..	March to April
Sweet Potatoes	October to November ..	February to June
Mangolds—		
Autumn	March to April	September to December
Spring	October to November ..	May to July
Potatoes—		
Autumn	February	May to June
Spring	August to October ..	January to February
Lucerne—		
Autumn	February, March, April ..	August to May
Spring	September to October ..	Following year

A. and P. Notes, N.S.W. Dept. of Agric.

Tree-planting Time Approaching.—Preparation of the Ground.

Because their wholesale removal has been necessary in the process of land settlement, trees have come to be regarded by many farmers almost as an excrescence. There are those, however, who appreciate that trees are of considerable importance in agricultural and pastoral economy, as sources of shade and shelter, fuel, fodder, and timber, and that on the score of beauty too they have a claim to their place on the farm. Such farmers may again be reminded that planting-time is now approaching, and that the best results will be obtained if the land is well prepared.

When forestry work is carried out on a big scale it is not possible to prepare the ground for planting as thoroughly as could be desired, and very often the only preparation consists of digging a small hole, or merely inserting the plant in a wedge-shaped notch made by a spade or notching tool. The farmer, on the other hand, has only a small area and a limited number of trees to deal with, and the necessary labour is usually supplied by himself in any spare time. Moreover, he requires quick and certain results, and must therefore ensure the best possible conditions for planting. In general forestry work allowance can be made for a number of failures, but in windbreak planting, for example, a single failure is much more important. Thorough preparation of the soil is therefore necessary.

Where a number of trees are being planted together, such as windbreaks, avenues, or tree lots, the land should be first ploughed. New land should be broken up before winter and allowed to lie until planting time. A plan which has its advantages is to make the first ploughing only deep enough to cover the grass and herbage. Shortly before planting the ground should be cross-ploughed deeply, and then harrowed. Ground previously under crops will probably contain many weed seeds, and to enable the young trees to become established before the weed growth becomes unduly aggressive such land should be ploughed and harrowed, and planted immediately afterwards with the trees. Where hillside planting is being carrried out, the ploughing should follow the contour of the hills as far as possible.

Ordinary hole planting is attended with some risks, especially where the subsoil is impervious. In such cases the hole tends to become merely a pool of stagnant water and a grave for tree life. Where trees must be planted in holes, such as in the case of isolated shade, shelter, and ornamental trees, the holes should be made as large as possible. A hole 3 feet by 3 feet and 2 feet deep is the smallest size allowable, and larger holes, where possible, should be made.

Where deep digging carries the hole into an impervious subsoil, it is better to make the hole wide and shallow, the depth not exceeding that of the soil. On wet, poorly-drained soil ridges or mounds may be formed as sites for planting. Ploughing two adjoining furrows so as to throw the sods together achieves this end in a minor way. Irrespective of what method is adopted, the preparation of the land should be completed before stock for planting is obtained.

The best time for planting is when the plant is at its resting period, and when moist, cool conditions prevail. Generally speaking, May to August are the best months. The effects of frosts must be studied, and spring planting is often necessary in some localities, except for deciduous species. Where the rainfall is heavy and conditions generally are cool, the planting period may be considerably extended. A cool, cloudy day and a fairly moist soil provide ideal conditions—A. and P. Notes, N.S.W. Dept. Agriculture.

Lean Bacon in Demand.

Altered demands the world over, and a steadily increasing demand for lean bacon and ham and for fresh pork products carrying a maximum of lean meat are matters with which the pig-raiser needs to become conversant. There is no call nowadays for the thick, heavy fat pork so popular years ago, nor does it pay to attempt to force on consumers the class of bacon for which they have no appetite. In order to obtain a maximum of lean meat it is essential that the pig's rations carry a maximum of flesh-forming foods, and for this purpose nothing is better than the by-products of the dairy—skim milk buttermilk, and to a lesser extent whey, with other animal proteins like meat meal used as a supplementary or substitute for flesh formers as well as vegetable proteins in the form of pollard, pea meal, barley meal, and succulent greenfoods. Under Australian conditions the feeding of carbohydrates (fat formers) must be carried out judiciously, otherwise there will be an excess of fat and a minimum of lean meat, instead of vice versa. Whatever the system of feeding, the objective must be lean bacon, otherwise the profits will diminish and the business become unprofitable.

Silos and Silage.

Based on more than ten years' experience of silos, Mr. Alex. Smith, of Bandon Grove, gave an informative address at the recent annual conference of the Upper North Coast District of the Agricultural Bureau of New South Wales. He said:—

My experience with silos and the making and feeding of silage dates from 1922. At that time I had some oats which were not required for feed. I was anxious to try to conserve it in a succulent form. It was only a small piece, such as many coastal dairy farmers have left over in a fair season. The weather at the time made hay-making rather risky. At that time pit silos were not considered advisable on the coast, nor the making of silage in quantities less than 50 tons. I decided that it was worth while to try if these small surpluses of green fodder could be successfully conserved as silage. A pit was excavated, estimated to hold about 20 tons, and filled and covered with soil. It turned out well, and the cows were quite satisfied with it. When this very small pit was filled with maize the produce was not as good as the oat silage, but still the cows appreciated it. I consider crops such as maize or sorghum should be chaffed, as an appreciable amount of the lower end of the stalk remains uneaten. I also think it advisable to give a pit a coating of concrete over netting laid on the bottom and along the sides. Getting silage out of an unroofed and unconcreted pit in damp weather is a messy and slippery job, and a pit that is to be used permanently should have a roof.

Later on we excavated another pit right on the bank of the Chicester River, estimated to hold about 44 tons. About 2 acres of oats and field peas were put in, also half an acre of Italian rye and golden tares, and 3 acres of lucerne. The Italian rye and golden tare mixture made the best silage I have ever seen, and the oats and peas were also good. This pit was later filled with maize, and not touched for four years. Then it was partly fed out, and the remainder used two years later. This pit was under water several times, but it had no detrimental effect.

An overhead concrete silo was built in the summer of 1931-32. The silo cost £94, not charging our own labour.

The cows received 30 lb. silage per day each, and sometimes during the winter nearly 40 lb., but instead of using expensive concentrates the cows had green oats in fine weather and hay in wet weather, and, in spite of the fact that they were used to having concentrates in the winter, the production this last winter was greater than I ever remember, and we saved the expense of the concentrates.

We have now made silage from crops at all stages of growth from before tasselling till nearly hard grain stage, but prefer to make maize silage when the grain is in the milk stage. When made at a later stage it is our experience that the grain passes through the alimentary canal of the cow unused and is, therefore, a dead loss. There is a better distribution of nutriment throughout the whole plant at the milk stage than at any later stage and it is in a more digestible and easier assimilable state.

A few years ago an Englishman at the School of Animal Nutrition, Cambridge, England, got the credit for the discovery that pasture plants in the leafy stage had a far greater feeding value than the same plants after they had started to produce stems and seed heads. I think our own Department of Agriculture should get the credit for this discovery. An article which appeared on page 657 of the "Agriculture Gazette of New South Wales," September, 1919, will bear out what I say. The credit of the discovery belongs to the New South Wales Department of Agriculture; the credit for emphasising it belongs to the Cambridge people. The grassland experts emphasise the importance of making silage from plants in the leafy stage.

The British Ministry of Agriculture recognises four types of silage:—

(1) *Sweet, Dark-brown Silage.*—Made when the material heats up too much and the temperature rises above 113 degrees Fahr. Factors contributing to this are a comparatively dry crop, either one that is dry from being mature, or from being allowed to dry somewhat after being cut. Such dry crops facilitate fermentation, both because they do not pack so tightly and thus allow air to penetrate the silo readily, and because the heat that is generated by fermentation has comparatively less moisture in the silage to heat, and consequently the temperature rises more.

(2) *Acid, Light-brown or Yellow-brown Silage.*—When less air is allowed to intrude than above, and the material does not heat up so much, this type commonly occurs (temperature range 86 to 104 degrees Fahr.). As a rule there is not much juice expressed from the silage when this type is being made. Acid brown silage is commonly made in pit and trench silos. This silage has a yellow-brown colour,

and an acid, though pleasant, smell, largely due to the presence of acetic acid, the yellowish types having the more pleasant smell. It is readily eaten by stock, which thrive upon it, and it is to be recommended. This is the most common form made, and it is much superior to the sweet, dark-brown variety.

(3) *Green "Fruity" Silage.*—Usually this quality is only made by chance, and it is hard to control conditions so as to make it with certainty. It is made by rapidly building fresh lush, leafy grass (temperature about 86 degrees Fahr., but no higher). This type has a green to olive-green colour, and a smell that is delicious —neither sweet nor sour—and is best described as "fresh" and "fruity." It is greedily eaten by stock, and it has recently been shown that its digestibility is very high. It has one disadvantage—much juice is lost.

(4) *Sour Silage.*—Sour silage has generally a dark-brown or olive-brown colour, and a pungent and very unpleasant smell, due largely to the presence of an acid. It is commonly made when a very immature and succulent crop is ensiled. In this case the watery fodder packs downs very closely in the silo and excludes the air to such an extent that little heating is possible. Thus crops of immature maize often give rise to sour silage. Again, sour silage is frequently found at the bottom of trench silos—especially if the material has been carted in wet weather, because the trampling of horse and cart over the trench, as well as the superimposed weight of silage, squeezes out the air and limits fermentation. Such defects may be obviated and the sourness reduced if the making of the silage proceeds slowly so that a certain amount of heating may occur in each layer of 3 or 4 feet before the next layer is put on. This sour silage has a high feeding value, and is quite palatable, despite its unpleasant smell.

In filling the silo, proper consolidation, by trampling, is, of course, important, but no less important is proper distribution. If this is not attended to the lighter and looser material, such as the leaf, is apt to fall in one area and a nest of mould is likely to develop.

Points in Citriculture.

Speaking at the annual conference of the Upper North Coast District of the Agricultural Bureau of New South Wales, Mr. K. D. McGillivray, of Moorland, said:—

I ask you to accept me as your guide on an expedition into the mind of an orchardist, hoping that we may see something of his mental processes and, if our understanding is keen enough, we may even catch a glimpse through his eyes, seeing things as he sees them.

The commercial orchardist's first duty to his trees is to practise a system of cultivation, manuring, and pruning that will ensure soil fertility and will encourage desirable cropping habits. The measure of his success, then, largely depends on his attention to pest control. An orchard pest is a living thing—belonging either to the animal or the vegetable kingdom—that interferes with the growth of trees or the production of high-grade fruit. The commercial grower must know how to deal with his pests.

The satisfaction that attends the growing of clean, healthy trees and clear-skinned fruit of good quality should be enough to encourage the non-commercial grower, who grows mainly for home use, to learn something of pest control. The appearance of the trees near his home and the health of his family would be expected to interest him, apart from other considerations.

If there is no appeal to him in these things perhaps he may have a sense of fairness and realise that by attending to pest control he will be getting rid of a centre of infection that may have been making life a burden to a man who is trying to make a living from fruitgrowing. If you have unhealthy trees you do not know how far the pest is spreading. If the home grower of fruit is still indifferent he may find himself in conflict with the Plant Diseases Act. The inspectors appointed under this Act have wide powers, and heavy penalties can be inflicted for neglect to comply with the regulations.

The gradual expansion of commercial citrus-growing on the North Coast makes this subject of special interest, and makes is imperative that owners of farms on which more or less neglected citrus trees are growing should make some effort to clean them up. What would a dairyman do to an orchardist who owned a diseased bull which he allowed to roam the district, or who sold milk and butter not being a registered dairyman? What can an orchardist do to a farmer whose neglected trees are breeding and spreading pests and who is unloading the product on to local markets—some of it good fruit, some inferior—and much of it being sold at prices that show no knowledge of market values? Due largely, perhaps, to the less organised

condition of orchardists, the law cannot give him similar protection to the dairymen. He can have the Act enforced, compelling the control of some pests and the destruction of some trees, but he cannot eliminate unfair competition. The orchardist does not deny the farmer the right to sell his surplus fruit, but he does think that the farmer should at least pay some attention to pest control and should learn something of market values. Grown without cost, any price may seem to be all profit, but that state of affairs cannot last. The commercial orchardist cannot afford to allow it to continue.

Mr. McGillivray had with him a number of diseased and pest-ridden specimens of citrus fruit and foliage, and he described the best measures of control or prevention for the different pests and diseases. Dealing with fruit flies, he said that these pests were well known on the coast—if not in the winged stage, then as grubs in peaches. Fruit flies could be controlled by systematic picking up and destroying of fallen fruit and by the use of traps or foliage poison sprays. They had a sympathetic ally in the loquat tree, the relationship between the two comparing to that existing between the blackberry and the rabbit. The loquat tree provided a breeding place that carried the fly through the winter and gave it an early start in the spring. Unlike most other fruits, loquats did not fall to the ground when infested with the fruit fly maggot and, consequently, the opportunity of burning, boiling, or burying the pest did not present itself.

Mr. McGillivray concluded by urging them not to leave old, unproductive fruit trees of any kind on the farm to die a lingering death, infested with every known pest. Treat useless trees with an axe, was his advice, and apply pest control measures to those that are producing fruit.

Care of Pig Weaners.

Weaning time is a very critical period in the life of a pig. If the young pig has been given feed in addition to what it has received from the mother it should have made a good start and should then be fed, at least twice daily, all that it will eat up clean. The young pigs should have the run of good fresh pasture if possible, and should be fed on crushed grains, pollard, and skim-milk, with lucerne, rape, or barley as green feeds, or pumpkins, mangolds, &c., if possible. All slop feed should be fed while sweet, and should preferably be given warm, after having been steamed for about four hours. The steaming of such grains as are given is attended by better results than merely soaking.

The pigs should have a shallow wallow (preferably of concrete) in which the water is kept as fresh as possible. Wood ashes, cinders, and a piece of rock salt should be available in the yards, which should be provided also with a dry shelter shed and bedding. Too many pigs should not be kept in one yard. When about three to three and a-half months' old any boars that may have been kept should be separated and placed in different small paddocks, where they should be kept until ready for penning prior to marketing as porkers or baconers.

An important point is always to have the pigs graded, so as to keep the same sized animals together, thus preventing large pigs from jostling the smaller ones at the feed trough. Pigs will be found to do much better if a system of grading is in force. Approximately forty pigs can be run to the acre, but the exact number will depend upon the size of the animals and upon the pasture provided.

To Remove Hair from Hides.

Soak the hide in fresh water, if it is a dried one, to which a few handfuls of washing soda have been added, until the hide is quite limp and soft as a fresh hide. Remove all scraps of fat, flesh, &c., and rinse once or twice.

Now put the limp hide in a solution of unslaked lime and water, in the proportion of 2 to 4 oz. of lime to the gallon. Soak for twenty-four hours; the hair should then come out. If not, make up a fresh liquid and soak again, when the hair will come away from the skin readily by scraping with a blunt instrument. Give the skin two or three soakings and rinsings to free it from any lime, and then spread out to dry in the shade.

Before the skin is quite dry, rub in a little mutton fat or tallow and work the skin well. It will then be soft and pliable when dry; this will make what is called "greenhide." Omit the fat or tallow if the skin is to be tanned.—"Journal of Agriculture," Western Australia.

Harvesting of Tobacco.

Much of the trouble encountered by the tobacco-grower when selling his tobacco is due to mistakes made at the time of harvesting. It is essential, writes the Tobacco Expert of the Department of Agriculture, that only leaf which is at the right stage of maturity should be picked for treatment by the flue-curing process. No method of curing will rectify harvesting at the wrong stage.

It will be observed that all the leaves on the plant do not ripen at the same time, but that in all cases the leaves start to mature from the bottom upwards. To secure the best results, and obtain an even cure, each leaf should be taken off separately as it reaches maturity. This, briefly, is what is meant by "priming."

The leaves are then placed in baskets or other suitable receptacles and taken straight to the barn to be strung in the shade, care being taken that after "priming" they are kept out of the sun as much as possible.

The leaves are then made up into "hands" containing four leaves each. A 4-feet stick will take about twenty "hands," ten on each side. In each "hand" of four leaves two should face one way and two the other, the middle two having their backs together. When the tobacco is to be flue-cured, the "hands" should not be jammed up close together, but there should be a space of a few inches between each on either side of the stick.

The method of stringing it is somewhat difficult to describe. The stem-butts of each "hand" are strung with a twist of the string, to hold them together. The string, which is about twice as long as the stick, is held fast permanently at one end by being pressed into a slit in the wood, and when the required amount of tobacco has been strung, the loose end of string is run through another split at the other end, and made secure. The grower quickly finds out how it is done, after a trial or two.

Hanging may also be carried out by threading each leaf with a needle and twine through the midrib, but the process is a tedious one. Yet another method is to put fixed wires through the curing stick 7 inches apart and so that they project 5 inches on each side. The leaves can be hung on the wires by piercing through the stem-butts. Leaf so strung is very liable to damage by tearing when the stick is being handled, and it is not possible to bulk down without removing the leaves from the wires.

PLATE 139.
A cotton farmer's home, Theodore, Dawson Valley.

The Home and the Garden.

OUR BABIES.

(Issued by the Queensland Baby Clinics.)

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

THE STORY OF SUGAR IN THE HUMAN BODY.

NOT the least of the marvels revealed by science is that of the activities of sugar in the human body. Sugar is always present in the blood, but in extremely small quantities—very nearly one part in a thousand. Yet if this proportion is lessened the subject loses muscular power, becomes faint and, if the proportion is still less, falls unconscious and speedily dies. For sugar in minute proportion is absolutely necessary to maintain the life of all his tissues, and in its absence the first to fail are the cells of the brain. But the proportion of sugar in the blood in health is strictly limited. Should it rise above two parts in a thousand the excess passes off in the urine. If the proportion persists above this level, he is a sick man. He is suffering from diabetes, a serious and often fatal disease.

Sugar is rapidly absorbed into the blood when taken in food, but the main portion in the blood is derived from starch, which is eaten in the form of bread, potatoes, and other common foods. This starch is slowly converted into sugar during the process of digestion. Sugar, therefore, enters the blood during and after meals, but is always being gradually used up by the living body, or more rapidly by violent muscular exertion, or in the production of heat when the body is exposed to cold. As sugar enters the blood in comparatively large quantities and is being used up, often very slowly, during the intervals, how is its quantity in the blood kept fixed within such narrow limits?

There is a large gland deep in the abdomen known as the sweetbread or pancreas. This secretes a fluid which takes a very important part in the digestion of food. But inside this gland are a number of little islands of a tissue which has quite a different function. They secrete a substance necessary for the continuance of life. This substance has recently been obtained from the pancreas of freshly-killed animals, and to it has been given the name "insulin." It has the marvellous property of converting the excess sugar in the blood into animal starch (glycogen), which is stored up partly in the muscles, but chiefly in the liver, and so rendered harmless. From these stores the sugar necessary is gradually released into the blood as it is needed.

Sugar may Cause Disease.

When the pancreas has been damaged by disease, it is unable to secrete sufficient insulin, and the man suffers from diabetes. By injecting small daily doses of insulin under the skin the excess of sugar in the blood can be prevented, and with very careful treatment the man may continue for many years in good health and capable of active work. He

is not cured of his disease, but its bad effects are prevented. In nearly all cases he has to continue his insulin injections to the end of his life. If he takes too little insulin his diabetes returns; if he takes too much (and it is often difficult to regulate the quantity) he becomes weak and faint, and unless he takes a good dose of sugar (which is strictly forbidden to the diabetic under ordinary circumstances) he may fall unconscious and die.

Use and Abuse of Sugar.

The self-protective powers of a healthy body are wonderfully elastic. They are sufficient against all ordinary contingencies. On a natural diet sugar is taken much diluted in milk, in fruit, or in the juices of some vegetables such as sugar-cane. Starchy foods are slowly digested, and impose no sudden strain on the tissue that secretes insulin. But pure concentrated sugar is an artificial product. Added to other foods in small quantities it is harmless and valuable. Taken in large quantities, its rapid absorption imposes an unnatural strain on the insulin-producing cells of the pancreas. Unless these are in a vigorous and healthy condition, serious harm may result. Diabetes is becoming an increasingly frequent disease among people of the British race.

There are rare conditions in which pure sugar is the best restorative. Among these is the athlete who is "all-in" after excessive muscular strain—the marathon runner, for instance. Some patients with degenerated heart muscle may stave off death for a time by increased sugar consumption; their urgent need justifies the risk. There are a few children who suffer from faint turns from decrease in their blood sugar. The most reasonable explanation is that their "islands" have been so stimulated by eating sweet things that they do not stop secreting insulin even when it is not wanted. These children need careful and prolonged medical supervision and treatment. Whether they are candidates for future diabetes is not yet known, but it is possible.

Sugar is therefore a food capable of causing serious harm when taken in excess. We have not here space to dwell on the serious conditions which have been revealed by the school dentists. It is pitiful to see children spending their pennies in destroying their teeth. Nor can we narrate how the over-eating of sweet and starchy foods has been found to diminish their power of resistance to infections. As a sugar-producing State Queensland has a special interest in these matters, for any attempt to increase the consumption of sugar beyond the limits of health is likely to recoil on the industry.

THE CHILD AT SCHOOL.

How to Care for His Eyes.

Miss Stella Pines, in a recent issue of the "Bureau Record" (Agricultural Bureau of New South Wales), writes:—

IT does not matter whether the child has his own governess, whether he has his lessons by correspondence, or whether he goes to a formal school or not, every day is a school day, for he is learning from example through his environment.

In the public schools, the school medical officer and the school nurse see every child at least once a year, and his defects are listed, and follow-up work is carried out to get the co-operation of the parents in having these defects rectified.

Just as the baby has every right to be given a good inheritance and be cared for in his helplessness, so the child of pre-school and school age needs a good overhauling every year to see that his body, both mentally and physically, is fit for the burden of everyday education, whether it be arithmetic, reading, spelling, or any of the other subjects, or that most precious of subjects, his health.

Because the child is growing, eating, and sleeping he may not be getting the best out of life or making the best use of his mind, for the simple reason that he may have a defect of hearing or his sight may be getting gradually worse, due to nearsightedness or farsightedness, and the harm may not be realised until a decided abnormality becomes apparent.

What can parents far out in the country do in order to know these things?

First of all, if your child does go to school, see that all defects pointed out by the nurse or medical officer are rectified as early as possible. But is quite a long time from his baby helplessness to the school age of five, six, or seven, and much can happen in that time. If, at any time, the bush nurse should visit you or the doctor should be called in for any one member of the family, take this opportunity, when the patient is convalescent, to have the whole family, including father and mother, overhauled, but especially the little run-about, for it was through the defects of children entering school for the first time that it was recognised that physical examination should be a necessary part of the school programme.

So much has been written of the child before he is born and in his first year that we will not spend much time except to give a few details. The younger the child the more easily he will learn good habits, for he will not have the difficult task of breaking bad ones to have them replaced by the good; so begin early and get your child ready for school. The best time to begin is, of course, before he is born, and it is through the mother's health that this is accomplished. His right is to be born healthy, and then to be taught to live healthily. For the first year he is dependent upon his parents, and if he learns good habits during this time, regularity in feeding, sleeping, and elimination, if he is given the right kinds of food at the right time, has plenty of fresh air day and night, is clothed properly, and has sufficient exercise, he has the best foundation for his school life.

When he begins to run about he becomes a social little being, and it is at this time that he begins to poke into everything, becomes a regular little busybody and wants to know the whys and wheres of everything. He still needs to be fed regularly, and all the other rules of health.

Is He Looking at the World the Way He Should?

His eyes are one of his most precious possessions, and defects are frequently overlooked. The child with defective eyesight does not know he does not see well, for he sees as he always does. See if the child looks at you or his toys with both eyes alike, or whether he squints; if he does, the good eye does all the work and the other gets weaker for want of use. Observe if his lids are red, or if there is any watery discharge, if he avoids light, or if he holds things far away or too close. All these things should make you suspicious, and he should see a doctor, not just a man who fits glasses. You can easily test your child out by having him read certain things at different distances and of different sizes, first covering one eye and then the other.

For the school child, observe him when he is doing his lessons. See if he makes frequent mistakes with letters or figures. He may complain that things look blurred, he may again say he has frequent headaches, or that he has pain in his eyes, or he may again hold his books far away or too near. See that he has a good light to read by, especially at night. He should be encouraged to sit where the light comes in over his left shoulder, and he should never be allowed to read out in the sun with the sun striking the book itself. He should not be allowed to read lying down, except in a good light, when he is lying face down as children love to do. A shade should be worn to protect him from any very bright lights, and the light should not shine directly into the eyes.

Because a child has been fitted with glasses this year they will not last him a lifetime, for as he grows his eyesight changes and he needs his glasses adjusted periodically. A poor report from school should always receive the attention of the parents and the cause found for it.

Prevent Accidents.

A few words about preventing accidents to the eyes. Never allow a child to play with sharp-pointed instruments, as they are apt to slip, and the child plays so intently that he is mostly leaning over the objects of his play. Teach him the

right use of scissors, and other pointed things, for many a child has had injury to the eyes through trying to open a bottle or something of the kind with a fork or scissors or knife.

Teach him the right way of playing with fireworks, how to protect their eyes from fire and great heat, very bright glares, and, above all, not to play with explosives and lime. Within twelve months I have come across three children, one completely blind, and the other two with just the faintest glimmer of eyesight, through playing with lime in bottles.

Teach a child who wears glasses how to protect them, and always to walk into a darkened room with his hand before his face so as to protect his glasses.

If at any time one of the family should meet with an accident to the eyes or get a piece of metal in them, move heaven and earth to get him to a doctor.

Mothers far back in the country away from help when a child is born, should see that his eyes are well cleaned at birth. If your doctor or nurse is there they will attend to this, but there are times when there is only a neighbour or perhaps a husband, so have ready some cotton wool and cool, boiled water, and wipe each eye separately from the nose outwards, with separate cotton wool balls, and if one eye should at any time become infested be careful to protect the good one.

Do not wipe a child's eyes with your handkerchief, especially when you have a cold. "Safety first" and "prevention" should be the watchwords of your treatment of your school child.

IN THE FARM KITCHEN.

A Cleanser for Kitchen Use.

Ingredients.—1 cake sand soap; 1 small packet Lux; 1 packet soap powder; ¼ cake of either Sunlight or Lifebuoy soap; 7 cups water.

Method.—Powder sand soap and mix with soap powder and Lux and shave the soap. Boil all together for seven minutes; stir well all the time it is boiling as the sand soap goes to the bottom of the vessel. Take off fire and stir till it cools. Put in tins. This makes a good quantity.

Home-made Soap.

Ingredients.—5 lb. clear fat, free from salt; 1 lb. caustic soda; 8 quarts of rain water; 1 lb. resin, finely crushed; ¼ cup borax; 1 cup of kerosene; 1 small packet of Lux.

Method.—Put all materials into a kerosene tin at the same time, and bring to boiling point. Then simmer for about two or three hours, on side of stove; the mixture should then be of the consistency of honey. Prepare moulds by wetting with cold water, stir well, and turn the mixture into them cover up, and stand for two days. Turn out and cut into bars, put on shelf to dry, and turn occasionally so as to ensure drying evenly.

Caution.—When bringing to the boil, stir frequently and watch closely or the contents will boil over quickly. A good vessel for mould is to cut a kerosene tin lengthways which will make two.

Table Salt.

Take 2 cups common salt, rolled finely. Then add 1 tablespoon cornflour and mix thoroughly.

If liked a little finer add a little more cornflour.

Articles Made from Flour Bags.

Flour bags can be made use of for a number of purposes on the farm.

Four 50-lb. flour bags make a kitchen tablecloth.

One 50-lb. flour bag makes a kitchen apron.

One 25-lb. flour bag makes a child's play apron.

One 25-lb. flour bag makes a pair of rompers.

To remove the letters or printing from the bags, wash newness out, soap well, put in cold water with a handful of washing soda and boil; then rinse well.

Lemon Trifle.

(1) Put water and sugar on to heat. Blend the cornflour with the juice from the lemons and grate the rind from two of the lemons.

(2) Add the grated rind and the blended cornflour to the water and sugar and bring to the boil. Cook gently for two minutes, stirring all the time.

(3) Allow to cool slightly, then add the beaten yolks of eggs. Cook carefully without boiling.

(4) Make a pyramid of sponge cake in a glass dish. Sprinkle some crushed ratafias over it.

(5) Pour the cool lemon mixture over the cake and allow to become quite cool.

(6) Beat the whites of eggs to a stiff froth and fold in four large tablespoons castor sugar. Decorate the trifle with this meringue. Sprinkle with chopped nuts.

Ingredients.—1 quart water; 4 eggs; 4 lemons; 2 tablespoons cornflour; 1 cup sugar.

Lemon Fluff.

(1) Put the milk to heat, then add the blended cornflour and sugar. Bring to the boil and cook three minutes.

(2) Cool slightly, stirring occasionally, and when cool add the juice of two lemons and the whites of eggs, stiffly beaten.

(3) Stir the mixture well. Wet a plain mould and decorate it with the lemon cut in thin slices. Pour in the fluff and when cold turn into a glass dish. Serve with boiled custard made from the yolks.

Ingredients.—1 pint milk; 2 tablespoons cornflour; 3 tablespoons sugar; 3 lemons; whites of 3 eggs.

Orange Delight.

(1) Bring sugar and water to the boil, add the cornflour, blended with the orange juice, and the grated rind of one orange.

(2) Cool a little, then add stiffly beaten whites of eggs and beat rapidly till white and foamy.

(3) Pour into a wet mould and serve with boiled custard.

Ingredients.—1 cup sugar; 2 good tablespoons cornflour; 1 pint water; 2 oranges; whites of 2 eggs.

Lemon Meringue Pie.

(1) Line the sides of the pie-dish with the pastry.

(2) Put the sugar and water on to heat, pour in the blended cornflour and cook five minutes.

(3) Add the grated rind of one lemon and the juice of three lemons.

(4) Cool a little, then add the beaten yolks. Mix well.

(5) Beat the whites stiff, then fold them very carefully into the mixture.

(6) Put into the pie-dish. Make a lattice of pastry strips over the top. Bake 20 to 25 minutes in a moderate oven.

Ingredients.—½ lb. flaky pastry; ¾ pint boiling water; 3 lemons; 2 eggs; 2 tablespoons cornflour; ¾ cup castor sugar.

Orange Pie.

(1) Beat the yolks with the sugar, add 1 tablespoon butter, then the juice of the oranges, and lastly the milk.

(2) Bake in a pie-dish.

(3) When cooked, set to cool, then pour over it the whites stiffly frothed and sweetened, and place in the oven to brown.

Ingredients.—Pulp and juice of two oranges and a little of the grated peel; 3 eggs; 1 cup sugar; 1 cup milk.

Orange Cake.

(1) Beat butter and sugar to a cream. Then add eggs one at a time and juice and rind of oranges.

(2) Lastly the dry ingredients and bake in a moderate oven 40 minutes.

Ingredients.—1 cup sugar; 1½ cups flour; ½ cup butter; 3 eggs; 1½ teaspoons baking powder; juice of two naval oranges and rind of one.

Mandarin Jam.

(1) Cut fruit finely, peel lemons and cut finely.

(2) Boil till tender with the 5 pints of water.

(3) Stand aside till quite cold, add sugar and boil till jellies, about 1½ hours.

Ingredients.—20 thorny mandarins; 5 lb. sugar; 5 pints water; 2 lemons.

Mixed Citrus Marmalade.

(1) Cut up the fruit overnight and soak it in all the water.

(2) Boil next morning until tender. Then add a pint of boiling water and lastly 10 lb. sugar.

This makes a rich jellied marmalade which is simply delicious.

Ingredients.—4 mandarins; 3 grapefruit; 2 naval oranges; 2 lemons; 10 pints water; 10 lb. sugar.

Lemon Jam.

(1) Cut lemon finely and stand over night with the cups of water.

(2) Boil till tender, then add sugar and boil fast till jellies.

Ingredients.—1 medium-sized lemon; 1 cup sugar; 2 cups water.

KITCHEN GARDEN.

Cabbage, cauliflower, and lettuce may be planted out as they become large enough. Plant asparagus and rhubarb in well-prepared beds in rows. In planting rhubarb it will probably be found more profitable to buy the crowns than to grow them from seed, and the same remark applies to asparagus.

Sow cabbage, red cabbage, peas, lettuce, broad beans, carrots, radish, turnip, beet, leeks, and herbs of various kinds, such as sage, thyme, mint, &c. Eschalots, if ready, may be transplanted; and in cool districts horse radish can be set out.

The earlier sowings of all root crops should now be ready to thin out, if this has not been already attended to.

Keep down the weeds among the growing crops by a free use of the hoe and cultivator.

The weather is generally dry at this time of the year, so the more thorough the cultivation the better for the crops.

Tomatoes intended to be planted out when the weather gets warmer may be sown towards the end of the month in a frame where the young plants will be protected from frost.

A REMINDER TO ONION GROWERS.

Onion seed growers should, by this, have gone through their selected onions with the object of picking out the best keepers for the production of seed. The bulk of these onions should have been selected, previous to storing, for early maturity and variety characteristics. At the final selection bulbs that are soft or prematurely shooting, or those showing any indication of being bad keepers, or that are diseased, should be discarded.

The bulbs should be planted in rows at least 3 feet apart and spaced 2 feet apart in the rows. A handy position well protected from the boisterous winter winds should be selected for the growing of onion seed.

THE FARM VEGETABLE GARDEN.

The question of drainage should be considered in relation to all classes of soil, but especially in relation to those that are at all heavy. Neglect to make the necessary provision on such soils explains many failures to get good results from them during the winter months. Now is the time to think of the question of treatment.

Briefly, the objects of drainage are (1) to enable as much water as possible to percolate through the soil, and (2) to prevent the lodgment and stagnation of water on the soil surface by enabling excess quantities of water to be carried away with ease. It is especially necessary, of course, to drain clay soils. If water is allowed to remain on these for long they tend to "puddle," but if the water is drained away the soil does not become so compacted, retaining, instead, a more friable (crumbly) and porous condition.

Drainage may be of two kinds—surface or underground; the latter is the more effective, but it entails more labour and expense. A simple surface drainage scheme consists of shallow trenches running between plot and pathway, and connected up to an outlet at a suitable point. A modified form of surface drainage is expressed in a system of raised beds. Where some form of drainage is necessary, and the installation of the underground system is impossible, either of these methods is to be commended.

Underground drainage necessitates a considerable amount of trench digging. On what plan it is advisable to set out the drains will depend upon the size and contour of the area. In some cases a herring-bone design may be applicable, the main trench forming the backbone, so to speak, and running through the lowest portion of the land and the smaller contributory trenches spreading upwards from this. In other cases it may only be necessary to feed the main trench from one side, while in others again main trenches may best be laid at the edges of the area and fed from the centre. These trenches may then be partially filled with broken stones, and the surface of the filling protected with a layer of tin or brushwood, so that the earth with which it is subsequently overlaid may not drop through and destroy the porous character of the filling.

A drain provided with this rubble filling is usually the most convenient to make, and is quite effective; but a roughly-built conduit or channel may take the place of the broken stones, if desired. This may be made of flat stones or bricks, or (failing either of these) of boards. Only the sides and top need be formed of these materials, the trench floor serving for the bottom. The stones or bricks, or whatever is used, should only be loosely laid together, so that water may fall into the trench through them and be carried off. In country gardens, where saplings are easily available, these may be used effectively in the bottom of the trench (say a foot deep), covered by a 6-inch layer of brushwood.

The depth at which the drain should lie will depend upon the class of soil, but, needless to say, it should be sufficiently deep to allow of cultivation above it. If there is difficulty in arranging this the scheme should be so adjusted that the drain runs underneath the garden pathways, and not under the beds proper; 2 ft. 6 in. to 3 ft. is usually a satisfactory depth at which to lay a drain in the ordinary household plot.

There is little necessity for drainage on sandy soils, but gardeners working on land of a heavier character should set to work now to repair any deficiency in this direction. If the contour of the plot is regular it is not necessary to do the work all at once. As a section of the plot becomes vacant opportunity may be taken to carry out drainage work on it prior to preparing it for another planting. Then, when each section of the garden has been dealt with, the scheme can be connected up.—A. and P. Notes, N.S.W. Department of Agriculture.

Farm Notes for June.

FIELD.—Winter has set in, and frosts will already have been experienced in some of the more exposed districts of the Maranoa and Darling Downs. Hence insect pests will to a great extent cease from troubling, and weeds will also be no serious drawback to cultivation. Wheat sowing should now be in full swing, and in connection with this important operation should be emphasised the necessity of at all times treating seed wheat by means of fungicides prior to sowing. Full directions for "pickling" wheat by copper carbonate treatment are available on application

to the Department of Agriculture, Brisbane. Land intended for the production of early summer crops may now receive its preliminary preparation, and every opportunity taken advantage of to conserve moisture in the form of rainfall where experienced; more particularly so where it is intended to plant potatoes or early maize. Where frosts are not to be feared the planting of potatos may take place in mid-July; but August is the recognised month for this operation. Arrowroot will be nearly ready for digging, but we would not advise taking up the bulbs until the frosts of July have occurred. Take up sweet potatoes, yams, and ginger. Should there be a heavy crop, and consequently a glut in the market, sweet potatoes may be kept by storing them under cover and in a cool place in dry sand, taking care that they are thoroughly ripe before digging. The ripeness may be known by the milky juice of a broken tuber remaining white when dry. Should the juice turn dark, the potato is unripe, and will rot or dry up and shrivel in the sand pit. Before pitting, spread the tubers out in a dry barn, or in the open if the weather be fine. In pitting them or storing them in hills, lay them on a thick layer of sand; then pour dry sand over them till all the crevices are filled and a layer of sand is formed above them; then put down another layer of tubers, and repeat the process until the hill is of the requisite size, and finally cover with either straw or fresh hay. The sand excludes the air, and the potatoes will keep right through the winter. In tropical Queensland the bulk of the coffee crop should be off by the end of July. Yams may be unearthed. Sugar-cane cutting may be commenced. Keep the cultivator moving amongst the pineapples. Gather all ripe bananas.

Cotton crops are now fast approaching the final stage of harvesting. Growers are advised that all bales and bags should be legibly branded with the owners' initials. In this matter the consignor is usually most careless, causing much delay and trouble in identifying parcels, which are frequently received minus address labels.

Orchard Notes for June.

THE COASTAL DISTRICTS.

THE remarks that have appeared in these notes for the past two months apply in a great measure to June as well, as the advice that has been given regarding the handling, grading, packing, and marketing of the citrus crop still holds good. As the weather gets cooler the losses due to the ravages of fruit flies decrease, as these insects cannot stand cold weather, and consequently there is only an odd one about. The absence of flies does not, however, permit of any relaxation in the care that must be taken with the fruit, even though there may be many less injured fruit, owing to the absence of fruit-fly puncture, as there is always a percentage of damaged fruit which is liable to speck, which must be picked out from all consignments before they are sent to the Southern States if a satisfactory return is to be expected. If the weather is dry, citrus orchards must be kept in a good state of tilth, otherwise the trees may get a setback. Old worn-out trees can be dug out and burnt; be sure, however, to see that they *are* worn out, as many an old and apparently useless tree can be brought round and made to bear good crops, provided the trunk and main roots are still sound, even though the top of the tree is more or less dead. The whole of the top of the tree should be cut off and only the trunk and such sound main limbs left as are required to make a new head. The earth should be taken away from around the collar of the tree, and the main roots exposed, any dead roots being cut away and removed. The whole of the tree above ground and the main roots should then be dressed with a strong lime sulphur wash or Bordeaux paste. The main roots should be exposed for some time, not opened up and filled in at once. Young orchards can be set out now, provided the ground is in good order. Don't make the mistake of planting the trees in improperly prepared land—it is far better to wait till the land is ready, and you can rest assured it will pay to do so in the long run.

When planting, see that the centre of the hole is slightly higher than the sides, so that the roots, when spread out, will have a downward, not an upward, tendency; set the tree at as nearly as possible the same depth as it was when growing in the nursery, cut off all broken or bruised roots, and spread those that remain evenly, and cover them with fine top soil. If the land is dry the tree should then be given a good watering, and when the water has soaked in the hole can be filled up with dry soil. This is far better than watering the tree after the soil has been placed round it and the hole filled up. Custard apples will be ripening more slowly as the nights get colder. If the weather becomes unduly cold, or if immature fruit is sent South, the fruit is apt to turn black and be of no value. This can easily be overcome by subjecting the fruit to artificial heat, as is done in the case of bananas,

during the cooler part of the year, when it will ripen up properly and develop its flavour. Grade custard apples carefully, and pack in cases holding a single layer of fruit only for the Southern markets.

Pineapples, when at all likely to be injured by frost, should be protected by a thin covering of bush hay or similar material. The plantation should be kept well worked and free from weeds, and slow-acting manure, such as bonedust or island phosphates, can be applied now. Lime can also be applied when necessary. The fruit takes longer to mature at this time of the year; consequently it can be allowed to remain on the plant till partly coloured before gathering for the Southern markets, or can be fully coloured for local use.

Banana plantations must be kept worked and free from weeds, especially if the weather is dry, as a severe check to the plants now means small fruit later on. Bananas should be allowed to become full before the fruit is cut, as they will carry all right at this time of the year; in fact there is more danger of their being injured by cold when passing through New England by train than there is of their ripening up too quickly.

Bear in mind the advice given with regard to the handling, grading, and packing of the fruit. It will pay you to do so. Land intended for planting with bananas or pineapples during the spring should be got ready now.

Strawberries require constant attention, and, unless there is a regular and abundant rainfall, they should be watered regularly. In fact, in normal seasons an adequate supply of water is essential, as the plants soon suffer from dry weather or strong, cold westerly winds. Where not already done, vineyards should be cleaned up ready for pruning—it is, however, too early to prune or to plant out new vineyards.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

ALL kinds of deciduous fruit trees are now ready for pruning, and this is the principal work of the month in the orchards of the Granite Belt area. Don't be frightened to thin out young trees properly, or to cut back hard—many good trees are ruined by insufficient or bad pruning during the first three years. If you do not know how to prune, do not touch your trees, but get practical advice and instructions from one or other of the Departmental officers stationed in the district. In old orchards do not have too much bearing wood; cut out severely, especially in the case of peaches, or you are likely to get a quantity of small unsaleable fruit. There are far too many useless and unprofitable fruit trees in the Granite Belt area, which are nothing more or less than breeding-grounds for pests, such as fruit-fly, and are a menace to the district. Now is the time to get rid of them. If such trees are old and worn-out, take them out and burn them, but if they are still vigorous, cut all the tops off and work them over with better varieties in the coming season—apples by grafting in spring and peaches and other stone fruits by budding on to young growth in summer. Planting can start now where the land is ready and the trees are to hand, as early-planted trees become well established before spring, and thus get a good start. Be very careful what you plant. Stick to varieties of proved merit, and few at that, and give so-called novelties and inferior sorts a wide berth. Take the advice of old growers, and do not waste time experimenting with sorts that have probably been tested in the district and turned down years ago. When land is intended for planting this season, see that it is well prepared and well sweetened before the trees are put in, as young trees seldom make a good start when planted in sour and badly prepared land.

Slowly acting manures—such as bonedust, meatworks manure, or island phosphates—can be applied now, as they are not liable to be washed out of the soil, and they will be available for the use of the trees when they start growth in spring. Lime can also be applied where required. Badly drained land should be attended to, as no fruit trees will thrive with stagnant water lying round their roots.

On the Downs and Tableland all kinds of fruit trees can be pruned now, and vines can be pruned also in any district where there is no danger from late frosts, and where this can be done the prunings should be gathered and burnt, and the vineyard ploughed up and well worked to reduce the soil to a good state of tilth, so that should rain come it will absorb all that falls and the moisture can be kept in the soilby cultivation subsequently.

Citrus fruits will be at their best in the Western districts. The trees should be watered if they show signs of distress; otherwise all that is necessary is to keep the surface of the land well worked. All main-crop lemons should be cut by this time, as, if allowed to remain longer on the tree, they only become overgrown and are more suitable for the manufacture of peel, whereas if cut and cased now they will keep in good order so that they can be used during the hot weather.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF MARCH, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING MARCH, 1934, AND 1933, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Mar.	No. of Years' Records.	Mar., 1934.	Mar., 1933.
North Coast.	In.		In.	In.
Atherton	8·30	33	14·36	2·53
Cairns	17·87	52	19·11	12·48
Cardwell	15·62	62	8·87	2·87
Cooktown	15·03	58	9·81	8·81
Herberton	7·51	48	12·80	1·28
Ingham	15·50	42	8·49	4·96
Innisfail	25·87	53	32·38	10·05
Mossman Mill	17·32	20	27·16	12·23
Townsville	7·29	63	0·85	0·33
Central Coast.				
Ayr	6·49	47	0·22	0·13
Bowen	5·56	63	1·62	0·24
Charters Towers	3·74	52	0·59	0·02
Mackay	11·81	63	6·47	0·88
Proserpine	11·76	31	10·33	6·04
St. Lawrence	5·23	63	0·46	0·62
South Coast.				
Biggenden	3·77	35	0·95	0·28
Bundaberg	5·04	51	1·85	0·84
Brisbane	5·65	83	0·82	0·55
Caboolture	7·55	47	4·30	1·85
Childers	4·43	39	1·35	0·21
Crohamhurst	11·27	40	4·79	2·00
Esk	4·72	47	0·78	0·04
Gayndah	3·02	63	0·65	0
Gympie	6·11	64	2·38	0·33
Kilkivan	3·85	55	0·41	0
Maryborough	5·88	63	2·53	0·96
Nambour	9·10	38	3·97	2·75
Nanango	3·38	52	0·54	0·04
Rockhampton	4·41	63	0·23	0·11
Woodford	7·80	47	3·40	1·50
Central Highlands.	In.		In.	In.
Clermont	3·05	63	0·03	0·10
Gindie	2·62	34	..	0·30
Springsure	2·91	65	0	0·42
Darling Downs.				
Dalby	2·67	64	0·01	0·05
Emu Vale	2·34	38	0	0
Hermitage	2·18	27	0	0
Jimbour	2·52	46	0	0
Miles	2·65	49	0·05	0·86
Stanthorpe	2·62	61	1·03	0·85
Toowoomba	3·72	62	0·23	0·27
Warwick	2·48	69	0	0
Maranoa.				
Roma	2·57	60	0·23	0·01
State Farms, &c.				
Bungeworgorai	1·55	19	0·40	0·75
Gatton College	3·17	34	0·32	0·08
Kairi	7·69	19	..	2·55
Mackay Sugar Experiment Station	10·84	36	5·30	0·96

GEORGE G. BOND, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—MARCH, 1934.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature. Means. Max.	Means. Min.	Extremes. Max.	Date.	Min.	Date.	Rainfall. Total.	Wet Days.
Coastal.	In.	Deg.		Deg.		Deg.		Points.	
Cooktown	29·81	84	74	86	1, 3, 11, 14, 23, 31	71	16, 26	981	23
Herberton	..	75	62	79	25, 26	56	20	1,280	22
Rockhampton	29·98	86	68	91	20	64	20	23	4
Brisbane	30·08	81	65	86	20	60	29	82	10
Darling Downs.									
Dalby	30·05	86	59	93	7	50	29	1	1
Stanthorpe	..	78	54	88	1, 24	45	6, 19	103	7
Toowoomba	..	78	59	86	24	49	19	23	2
Mid-interior.									
Georgetown	29·85	90	68	94	24, 25	60	21	24	3
Longreach	29·94	95	68	100	1	60	29	12	2
Mitchell	30·02	88	61	95	7, 22	52	21, 29	35	1
Western.									
Burketown	29·83	91	74	99	12	71	29	96	5
Boulia	29·87	96	73	100	2, 12, 19-22, 25	69	8, 29	Nil.	..
Thargomindah	29·95	95	73	105	1	64	26	Nil.	..

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	May, 1934.		June, 1934.		MOONRISE. May, 1934.	MOONRISE. June, 1934.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	6·19	5·19	6·37	5·2	6·27	8·33
2	6·20	5·18	6·37	5·2	7·27	9·42
3	6·20	5·18	6·38	5·2	8·31	10·47
4	6·21	5·17	6·38	5·2	9·37	11·49
5	6·21	5·17	6·39	5·2	10·44	a.m.
6	6·22	5·16	6·39	5·2	11·48	12·51
7	6·22	5·16	6·39	5·2	a.m.	1·49
8	6·23	5·15	6·40	5·2	12·54	2·47
9	6·23	5·14	6·40	5·3	1·57	3·48
10	6·24	5·13	6·40	5·3	2·56	4·47
11	6·24	5·13	6·40	5·3	3·55	5·43
12	6·25	5·12	6·40	5·3	4·53	6·38
13	6·25	5·11	6·41	5·3	5 55	7·30
14	6·26	5·11	6·41	5·3	6·55	8·18
15	6·26	5·10	6·41	5·3	7·51	9·1
16	6·27	5·9	6·41	5·3	8·45	9·37
17	6·28	5·9	6·42	5·4	9·36	10·10
18	6·28	5·8	6·42	5·4	10·23	10·39
19	6·29	5·8	6·42	5·4	11·3	11·8
20	6·29	5·8	6·42	5·4	11·37	11·37
					p.m.	p.m.
21	6·30	5·7	6·43	5·4	12·9	12·8
22	6·30	5·7	6·43	5·4	12·39	12·40
23	6·31	5·7	6·43	5·4	1·7	1·16
24	6·32	5·6	6·44	5·4	1·37	1·58
25	6·32	5·6	6·44	5·5	2·10	2·51
26	6·33	5·5	6·44	5·5	2·44	3·54
27	6·34	5·5	6·44	5·5	3·24	5·2
28	6·34	5·4	6·44	5·5	4·12	6·12
29	6·35	5·4	6,44	5.6	5·10	7·24
30	6·35	5·3	6·44	5·6	6·14	8·34
31	6·36	5·2	..	..	7·23	..

Phases of the Moon, Occultations, &c.

6 May.	☽ Last Quarter	4 41 p.m.
13 „	● New Moon	10 30 p.m.
22 „	☾ First Quarter	1 20 a.m.
29 „	○ Full Moon	7 41 a.m.

Apogee, 19th May, at 5.54 a.m.
Perigee, 31st May, at 5.12 a.m.

The Moon will occult Antares, the principal star of Scorpio, about an hour after midnight of the 1st of May.

The nearest approach of Mercury to Mars, to within about half a degree on the 8th, will be prevented from being a popular spectacle by the closeness of the Sun, which passed Mars from west to east on the 14th of April.

The nearness of the Moon to Venus at 10 a.m. on the 10th will be interesting to notice, with or without binoculars, although in broad daylight. They will be high up towards the N.N.W., only 4½ degrees east of the 24th meridian, which may be said to run along the eastern side of the Great Square of Pegasus. The distance of Venus from the Moon on its southern or upper edge will be 6 degrees, the length of the Southern Cross.

On the 13th Mercury will be in superior conjunction with the Sun, and so remarkably in a line with it as to be only one minute of arc from the Sun's centre when directly behind it.

On the same day the Moon will be new at 10.13 p.m. It will reach Mars at midday and Mercury 14 hours later, but all three will be entirely lost in the glare of the Sun.

Neptune, having reached Right Ascension 10.46 on the 21st, will become stationary for about seven days, after which it will resume its eastern motion till the end of the year. From our point of view Neptune reached Leo on 24th July, 1922, and has remained with that constellation as its background up to the present time. About another years seems to be required before Neptune will reach Virgo.

The Moon will give a good indication of Neptune, which will be 4 degrees north of it, on the 22nd at 11 p.m., when both will be getting down to the western horizon.

The conjunction of Jupiter and the Moon will take place at 5 p.m. on the 25th, when Jupiter will be 7 degrees to the northward. An hour later both may be distinctly visible in the north-east, but the distance between them will then be 7½ degrees.

Antares will be again occulted on the 29th before midday, when the star and Moon will be 4½ hours below the western horizon.

4 June	☽ Last Quarter	10 53 p.m.
12 „	● New Moon	12 11 p.m.
20 „	☾ First Quarter	4 37 p.m.
27 „	○ Full Moon	3 8 p.m.

Apogee, 15th June, at 8.18 p.m.
Perigee, 28th June, at 10.54 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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QUEENSLAND AGRICULTURAL JOURNAL

VOL XLI. 1 JUNE, 1934. PART 6.

Event and Comment.

Carcass Competition—Export Meat Classes.

TO show producers their cattle, lambs, and pigs as dressed carcasses for export, a competition was conducted in the course of the month at the Brisbane Abattoir. It was the first competition of its kind in Australia. The idea at the back of it was to show the best type of cattle, lamb, and pig for the export trade. The competition attracted wide interest, and entries came from all parts of Queensland. There were 38 lots in the cattle section, comprising 380 beasts. They were of excellent quality, although some were over weight. The present demand is for smaller and quicker maturing animals. Although it is not the right season for lambs, the exhibits generally were excellent. The same tendency towards over weight was noticeable in the pig section. Nevertheless, the entries provided definite evidence why Queensland's export of pork has increased from almost zero three years ago to an important industry; and also why carcasses from the Brisbane Abattoir compete successfully with the products of other countries. The pigs included whites, middle whites, large whites, British blacks, Tamworths and Berkshires, and crosses of these breeds.

In opening the exposition on judging day, the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, said that it was interesting to recall that Queensland had more surplus meat for export than any other country in the British Empire. Despite all the talk of international agreements, quotas and restrictions, Queensland's meat industry was worth developing to an ever greater extent. The Meat Industry Board had had vision and had introduced a practice which would be of material benefit to Australia. From the experimental point of view, said the Minister, the lamb competition was the more important, and judging by the carcasses entered they had nothing to fear so far as the lamb industry is concerned. It had been stated recently that pork was the best exportable prospect for Queensland, and if they were able to build that trade up so much the better. The Meat Board was doing everything possible to foster the pork export trade. If producers did not utilise their by-products it would mean stagnation in the industry. The pig raising and exporting industry could be of great advantage to the dairy farmer in this respect. "We have a right to a share of the world markets, and the time is not far distant when that right will not be questioned as at the present time," remarked the Minister in concluding an able address on the Queensland Meat Industry.

Pure Milk Supply.

"THE idea seems essentially sound and the Council of the British Medical Association takes this opportunity of congratulating the Government upon a practical attempt to solve a difficult problem." This comment is contained in a statement issued by the Council of the British Medical Association in respect of the regulations recently gazetted on the subject of certified milk supplies.

For many years most medical men have felt that they could not safely advise the use of unboiled milk for infants and young children, notwithstanding the many advantages of raw milk. Previously, there was a feeling that the proposed legislation to improve the quality of the milk would have tended to the raising of its price, so that it could not have been available to poorer children in sufficient quantities. The present Ministry has devised a practical solution which should allow consumers to obtain a purer supply of milk at little or no increase in cost, and, at the same time, give dairymen who are prepared to supply it an advantage commensurate with their increased outlay. The Council of the British Medical Association has given careful consideration to the regulations, and has noted with satisfaction the two high qualities of milk which have been prescribed. But until this high standard is attained in the production of a pure raw milk, pasteurisation must be looked upon as our chief safeguard in establishing a pure and safe milk supply.

"Certified milk" which has to be cooled, bottled, and sealed immediately after milking and delivered in that condition to the consumer, would, no doubt, command a higher price than that ruling to-day, on account of the expense entailed in installing the necessary plant, but the consumer would be sure of obtaining a safe and pure milk especially suitable for consumption by infants in a raw state. Milk from a certified dairy, for which a similar bacteriological and chemical standard had been prescribed, should, however, be sold at the same general price as that operating at present. This quality of milk does not require to be bottled, but the consumer would know that the milk comes from a healthy

herd and from a hygienic dairy. This milk should be safe for consumption in a raw state by children and adults, and would be a great advance upon anything that has previously been obtainable.

The Medical Council is of the opinion that the dairyman who voluntarily produced "certified milk" or "milk from a certified dairy," should reap some reward for his enterprise and for the high quality of his milk, and is pleased to note that the householder may distinguish such dairymen by the designs on the milk vehicles: the vehicles painted white with a blue star for "certified milk" and with a blue band for "milk from a certified dairy." No other dairymen are permitted to use on their vehicles anything which resembles these designs. The scheme, although entirely voluntary, is calculated to overcome the two main difficulties to be encountered in improving the city's milk supply—the elimination of cattle affected by disease which might be conveyed to humans per medium of the milk, and the observance of scrupulous cleanliness in the dairy and in delivery to protect the milk from infection before it reaches the consumer.

The provision that all herds must be tested and remain under test, and all animals affected by disease destroyed, would possibly entail loss to the dairyman; but, on the other hand, no milk supply could be considered satisfactory until this has been done. Also, in either case, the standard of hygiene required in the dairy and among its employees must be considered as higher than that reached by most dairies at the present time.

Briefly the regulations provide, in the case of "certified milk," that such milk should be produced on premises especially approved for the purpose by the Department of Agriculture and Stock, and from a herd every animal of which has been certified free from disease. Such milk requires to be cooled to 45 deg. F. and bottled immediately on the premises. The bottles require the name of the producer and the date of production and the words "Certified Milk" on the closing disc. The bacteriological standard is a maximum of 30,000 micro-organisms to the cubic centimetre during the summer period, and 20,000 per c.c. during the winter months. In chemical composition, it requires to conform with the ordinary standard for milk. The regulations further provide for the effective sterilisation of bottles and equipment, the institution of hygienic measures in milking operations, such as the effective cleansing of the hands and the udders and teats of cows; while provision is also made to ensure the freedom from disease of employees. A stringent clause has been inserted to prevent misrepresentation, either by verbal statement or advertising matter, thus protecting both the consumer and the legitimately certified milk vendor.

In the case of "milk from a certified dairy," similar provisions are made, except that such milk does not require bottling, but might be delivered in cans under the system at present prevailing. This quality of milk, however, requires to be retailed direct by the producer.

The Medical Council is of the opinion that the improvement of the city's milk supply is now in the hands of the consuming public. Upon their insistence to be supplied with "certified milk" or "milk from a certified dairy" depended the success or failure of the scheme. It feels sure, however, that the public generally will appreciate the efforts of dairymen who are prepared to meet the additional expense and trouble in producing a safe high-quality milk.

Queensland Citrus Scale Insects and their Control.

By W. A. T. SUMMERVILLE, M.Sc., Assistant Entomologist.

(Continued from page 486.)

PINK WAX.

PINK Wax was originally described by Maskell in 1892 under the name *Ceroplastes rubens.* In a paper published in 1900 Green included the insect in the species *C. myricæ* Green, an error which he afterwards corrected, and all important references to the insect in Australian literature will be found under the correct name *Ceroplastes rubens.*

Description.

The active reddish coloured larvæ are rather more often observed than most other species, as they are somewhat more conspicuous on the green leaves than are most other species on the parts on which they are to be found. On settling down, the young quickly secrete a white covering. As development proceeds a band of red or pink wax appears below the margin of this white cap, and this band gradually increases in size. Soon the appearance is as follows:—The white cap has increased, particularly in height; below this all round is a red margin, about as wide as the cap is high, broken by eight white prominences, three on each side and one at each end, forming a series of rays. The scale of the adult female (Plate 140) is almost globular in shape and smooth, except at the top where a slight depression occurs, and towards the margins where there are two lobes on each side, the anterior one of which is well defined and prominent. Towards the base the wax may be produced to form a well-defined flange. The colour is deep pink, except at the apex where the white dot persists, though it may lose much of its whiteness, and at the sides where narrow bands of white mark the positions of the stigmata. These white lines vary in length, and extend well on to the smooth area. In crowded colonies the outline may be confined to the length of the lobes down which they run or may be considerably modified by pressure of one scale against the next.

The adult female is very soft bodied, and in the field it is difficult to remove all the wax without injuring the insect. Denuded, it is found to be hemispherical in shape, with a cavity beneath into which the eggs are deposited. The colour varies from pink to reddish brown, and the legs are very small. The length of the female scale is from one-eighth to one-sixth of an inch. The adult male has not been observed in Queensland.

Distribution and Habits.

Pink wax was probably introduced into Australia from Ceylon or some neighbouring country. It has been recorded from Ceylon, Japan, the Hawaiian Islands, and elsewhere. The species is very common in the coastal parts of Queensland, and extends well into the interior also. The list of host plants is very long, and it may be said that it is never surprising to find pink wax on any plant, other than those typical of dry climates (*Xerophytes*). It is particularly prevalent on trees growing along watercourses near the coast, and river cherry trees *Eugenia* spp.,

PLATE 140.
Pink Wax Scale, *Ceroplastes rubens* Maskell, showing infestation of leaves and twigs.

almost always carry enormous populations. Such trees, which have a deep green foliage, commonly appear almost totally black in consequence of the growth of sooty mould which accompanies the pink wax on the leaves. Indigenous trees, particularly river cherry, form a constant and prolific source of infestation from which the scale spreads to orchard trees. A number of other cultivated plants are attacked, but the insect is usually of importance only as a citrus pest, though mango, custard apple, and ferns are at times severely infested. Figs (cultivated and indigenous), guava, banana, pomegranate, pepperina, eucalypts, and Brassaïa (Umbrella tree) are a few of the commonest host plants.

The eggs are encased beneath the scale in a concavity in the body of the female. On emerging, the young crawl around for a considerably longer time than do most species found on citrus. Observations on this point showed that the great majority of young do not settle down until at least three days after they emerge from beneath the mother. The period in which the distribution of the young may take place is correspondingly long and mechanical scattering is thus very effective. The most important means of dispersal is the wind, and trees, or portions of trees, exposed to the wind may be quickly infested from indigenous hosts considerable distances away. Thus it is usual for the tops of tall trees to become infested in the first place, and if the number of crawlers arriving in the orchard in this way is not very large the colonies may be confined to the few topmost branches. It is therefore the tops of trees which should be kept under observation in orchards which are free of the pest but which are liable to infestation. The pest may remain confined to the top branches for a considerable time, but usually the infestation spreads all over the tree when the following brood appears.

When settling down to feed the insects always select a position in which there is a plentiful supply of sap and where the tissue is very soft. Thus colonies are found only on leaves and tender twigs. On leaves the insects are usually confined to the midrib, or at least to one of the main veins (Plate 141). Both surfaces provide feeding areas, and citrus leaves are commonly found on which practically the whole of the midrib on both surfaces is hidden from view beneath the scales. Such leaves may carry over a hundred individual insects, and seventy on one side is not very uncommon.

As it is the most tender, freegrowing twigs which carry the colonies it is most frequently the wood which is bearing fruit, or which is to bear the following crop, that is affected. Though pink wax is not a particularly voracious feeder the numbers which are habitually present, together with the nature of the parts principally attacked, result in considerable injury. Leaves may be killed, but twigs succumb only in exceptional cases, and the most important direct result is the reduction in the size of the fruit. This reduction in size is often overlooked, but it has been shown to be very considerable. By reducing the vigour of affected twigs pink wax commonly paves the way for infestation by the more serious mussel scale. This forms part of a well-defined succession. A healthy tree becomes infested with pink wax, and the vigour is so impaired that mussel scale gains a hold. This leads to the destruction of small twigs and the weakening of larger ones. This in turn favours the entrance of melanose. Unchecked, the mussel and melanose together accomplish the death of larger twigs and branches,

and finally quite large limbs may succumb. The succession described is responsible for much of the dead wood which appears in otherwise healthy trees.

A further great objection to pink wax is that it always has associated with it a copious growth of sooty mould, and with no other scale occurring on citrus in the State is there nearly the same amount of this fungus. Heavily infested trees may present a uniform black appearance. Both surfaces may be covered completely by layers of fungus, and not only are the leaves so affected, but a proportion of the fruit may also be partially covered. Such trees may have more than 70 per cent. of the foliage effectively screened from the sunlight and practically every fruit somewhat blackened. The cutting off of the sunlight from the leaves is an important indirect effect of a heavy infestation by pink wax, for leaves so affected may be practically useless to the plant. It is, however, the fungus on the fruit that gives growers the greatest concern as a rule. The fruit must be cleansed before it can be marketed successfully, and though most of the black can be removed fairly easily by

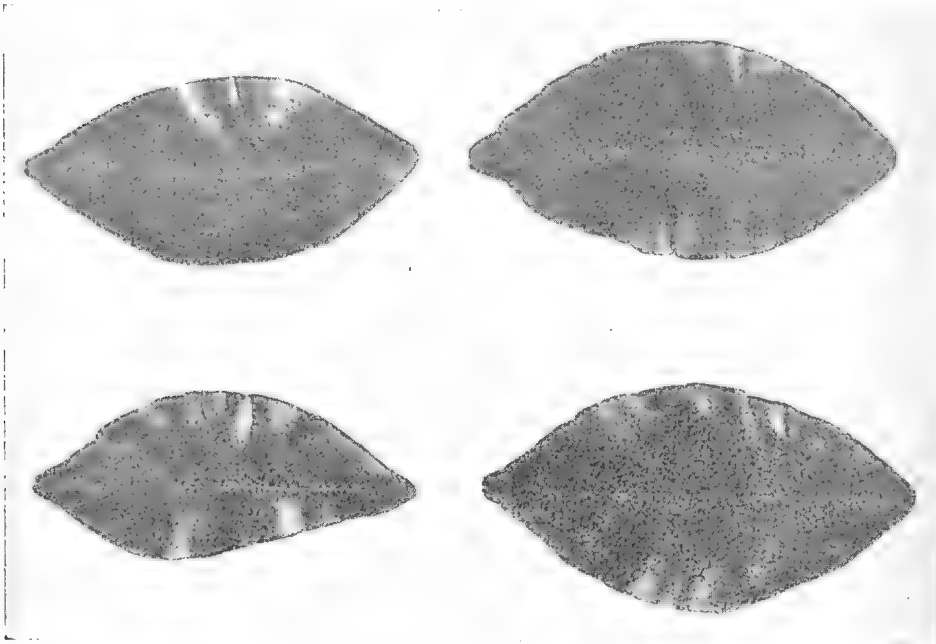

PLATE 141.
Pink Wax Scale, *Ceroplastes rubens* Maskell, showing young in correct stage for spraying.

brushing, the last traces often have to be washed off, particularly if the rind be at all rough. The Emperor of Canton mandarin, which is the variety most frequently calling for attention in this respect, is a soft fruit with a rind that is by no means smooth. As a general rule any attempt to remove the last residue of the fungus by extra use of a hard brush is likely to result in injury to the fruit. The pink wax and its associated growth of sooty mould are usually more in evidence in wetter seasons, and it is at such times as these that the common blue and green moulds cause most loss. A good deal of the loss through these rots is attributable to the handling the fruit receives before it leaves the

packing shed, and the removal of sooty mould by the use of dry brushes is particularly liable to cause injury to the rind at such times, thus facilitating the entry of the rot fungi. Washing in water containing borax is preferable at all times to brushing when large numbers of fruit have to be so treated, and in such circumstances as those discussed above dry brushing should never be employed.

Whilst all commercial varieties of citrus are susceptible to attack by pink wax, preference in this respect is very noticeable. In Queensland the pink wax is primarily a pest of the Emperor of Canton mandarin. It is grown extensively, and it is very rarely indeed that a tree of this variety does not harbour appreciable numbers of pink wax scales. Other mandarins are also favoured, particularly the Scarlet variety. Oranges, as a rule, are not greatly troubled by the pest, but Washington Navels, when young and very vigorous, frequently carry large populations. Seedling trees of the round orange type are also rather heavily infested at times. Lemons, on the other hand, are very seldom attacked, and it is uncommon to find even a few individuals on this species of citrus. The varietal preference is apparently dictated by the same urge which causes the insect to seek the favoured parts of trees. Thus even an Emperor of Canton tree which, on account of loss of vigour, is not carrying the usual supple tender fruit-bearing wood may be quite or almost free of the pest, and with all varieties the degree of infestation is dependent on the vigour of the tree. When favoured varieties growing in a position where infestation is probable do not become infested, it can be suspected at once that the health of the tree needs attention.

The incidence of pink wax is so closely bound up with the condition of the tree that even with indigenous plants it is sometimes found that a particular species will carry the scale only when there has been abundant new growth available when young scales were moving.

As high temperatures in coastal districts are usually associated with humid conditions and closely followed by rain, it is in such times that trees make their best growth, and thus pink wax increases noticeably at such times. In the interior parts, however, long periods of hot weather may occur without any appreciable fall of rain, and in these parts hot weather is commonly followed by a decrease in the populations of the insect. Long periods of low temperatures, on the other hand, appear to adversely affect the insect, and though mortality of insects in the winter is not at all marked, the early summer brood is usually much smaller than that in the late summer. Crawlers are not found in the coldest times, and therefore the effect of cold on the youngest stage has not been observed and is of no moment in Queensland. It will be seen by comparison that in many important characteristics pink wax may be directly contrasted with the red scale, and thus it is very unusual to find these two species on the same tree concurrently. Both species, however, may be found on the same tree in large numbers at times when a good spring has been followed by a long, dry summer. In such cases the pink wax is usually obviously distressed, and before control has to be established one or other of the species will usually not have to be considered. In years when the monsoonal rains are long delayed or very light, however, the control of both red and pink wax scales on the same tree may be required.

Life History.

Under normal conditions in the orchard there are two well-defined generations of pink wax each year. The times of commencement depend, of course, on a number of conditions and may vary a little. Generally the first brood following the winter may be expected to appear during November, but at times the main hatchings may be delayed until early December. December, January, and part of February, are passed in immature stages. Eggs are then again produced towards the end of February, or more typically early in March. No further broods occur until the following November. Each female may produce progeny over a period of about one month. When the weather remains very dry at about the normal time of reproduction, the appearance of the following generation may be delayed and hatchings then be spread over a longer period. That is to say, young are to be found over a longer period than usual, but this is due rather to variation in time of egg-laying by different individuals than to any very great prolongation of the period of fecundity of each female. Thus, when normal monsoonal rains are delayed the first female to reproduce may do so almost two months before the slower ones commence. This, fortunately, is not a common occurrence, for it is much more difficult to establish control under these circumstances than when young of approximately the same age are being combated.

On ferns and other such plants grown under artificial conditions the breeding of pink wax is sometimes affected, and irregular partial broods may be found. Growers are sometimes misled by the occurrence of such generations induced by the artificial conditions, and for the purpose of citrus growers only those trees outside the orchard which serve as sources of infestation need be considered. On these it will be found that there are the same number of broods as on citrus, but these broods may commence at slightly different times from those in the orchard. The variation, however, is slight and never of much consequence, except perhaps where irrigation is practised.

WHITE WAX.

White wax, *Ceroplastes destructor*, was described by Newstead in 1917. For many years the Queensland white wax scale was thought to be *Ceroplastes ceriferus* Anderson, and it is under this name that most of what has been published on the insect has appeared. During the course of investigations in New South Wales recently, however, Zeck[8] found that all the specimens he had from citrus were *Ceroplastes destructor* and not *C. ceriferus*. The evidence gained during the investigations now being recorded supports this conclusion, and though *C. ceriferus* occurs on a number of indigenous plants in Australia apparently it does not attack cultivated citrus.

Description.

The vernacular name aptly describes the appearance of the species (Plate 142). The young, on settling, are quickly covered by a waxy coating the margins of which are produced outwards in a series of arms or rays. The form soon changes, and the general shape is conical though the base may not be evenly rounded. As development proceeds the conical shape is lost and the scale becomes more or less globular in form, somewhat flattened on top, and with irregular protuberances on the sides. Colonies are typically so crowded that the outline of the individual

PLATE 142.

White Wax Scale, *Ceroplastes destructor* Newstead, showing infestation on small branch.

scales may be variously modified and the whole appear like a series of irregular masses of wax along the twig. The colour is at first white and rather shining, with a snow white line of flatter white marking the position of the stigmata. Later the general colour becomes duller, and old specimens may be almost grey. The male has not been observed in Queensland. The length of the scale of the female is three-eighths of an inch.

Distribution and Habits.

White wax scale was described from Uganda where it infests coffee, cocoa, Croton, and other plants. Zeck records it from more than twenty species of trees in New South Wales, and there is little doubt that most of those plants or allied species would be included in a complete list of hosts in Queensland. Little work has been done on this question in Queensland, and the only plants other than citrus from which the species can at present be definitely recorded are river cherry (*Eugenia* spp.), *Helichrysum diosmopholium,* Gardenia, persimon, and guava. The insects spread from these hosts to orchard trees, but it is seldom that white wax becomes a pest of commercial citrus in this State. It is more commonly found in orchards in coastal parts than in the interior. Even on the coast, however, it is usual to find only one or two trees in an orchard which carry more than a few individuals. Occasionally more general infestations do occur, both on the coast and further inland, and control measures have to be adopted, but the pest is nowhere as important in Queensland as it often becomes in New South Wales. Though the scale cannot be considered to be of more than minor importance in Queensland at the present time, there is some reason for thinking that its importance may be increasing. Certainly during the past twelve months more inquiries have been received concerning white wax than during any of the previous five years. This may be due to the influence of quite temporary factors causing an increase in populations, both in orchards and on uncultivated host plants, and it will possibly be found that the larger populations in orchards will not be maintained for any considerable period. Close observation of the position should be kept, however.

Life History.

Unfortunately, owing to the destruction of experimental trees by an outside agency the breeding work lacks the continuity necessary to enable a definite statement to be made. It appears, however, that there is but one generation each year. In 1932 large numbers of crawling young were found early in November. Young continued to emerge in large numbers throughout December. Those young which had emerged in November were used in the breeding work. By the following June a number of these were almost full grown in size, but the great majority were scarcely half that size. It was soon after this that the tree was destroyed. During July the greatest number of individuals observed in the orchards were approximately half grown, but late in that month (1933) a few females in one colony were found to be reproducing. Young were secured from these, but none survived to become established. No other young were found until the following November. Further young were observed in December and January.

It would appear then that normally there is but one generation each year commencing in November and December, or less typically early in

January. The occurrence of young in July was probably abnormal, and it would seem that mortality of crawlers at this time of the year is very high.

THE LONG TAILED MEALY BUG.

The long tailed mealy bug (*Pseudococcus longispinus* Targ.) was described by Targioni-Tozetti in 1867 under the name of *Dactylopius longispinus.* In much of the Australian literature the insect is referred to as *Dactylopius adonidum,* a name given it by Signoret in 1875. There are a number of other synonyms, but these are of little importance. The generic name *Dactylopius* is, however, now not applicable, and *Pseudococcus* is the correct name. In some recent literature this species is again referred to as *P. adonidum* the authority given being Linnaeus.

Description.

This mealy bug, like other members of its group of Coccidæ, does not remain stationary but wanders about the plant for the greatest part of its life. The insect is well described by the vernacular name. It is active, elongate oval in outline, and covered by a white mealy secretion. At the margins a series of filaments project well out from the sides of the body. At the posterior end are four filaments, two of which are noticeably longer than the body. It is unlikely that orchardists will confuse this insect with any other scale on citrus, but confusion occurs between this and the larvæ of the ladybird, *Cryptolæmus montrouzieri* Muls. The similarity, however, is not very marked. The ladybird larva is a flatter white in colour, and the projections from the sides of the body are much coarser in structure. The legs are stout and the jaws are prominent, whereas with the mealy bug the legs are slender and the mouth parts of the delicate sucking type. When observed together, as they commonly are, if the mealy bug be seen at all, the differences in general appearance are obvious, and only very young ladybird larvæ would be mistaken for the coccid. The length is one-sixth of an inch.

Distribution and Habits.

The long tailed mealy bug is widely distributed in tropical and semitropical countries, where it attacks a large number of plants. It also occurs in temperate countries, but in these regions it is usually a pest in hot houses.

The insect cannot be considered a pest of citrus in Queensland. Though it has been found in the Burrum, Gayndah, and Maroochy districts, it is seldom seen and never occurs in large numbers in orchards in this State. No injury attributable to this insect has been noticed in any orchard, and the insects are usually observed endeavouring to escape from the ladybird *C. montrouzieri,* or climbing the trunk of the tree when returning to the twigs after being removed by jarring.

Life History.

No work has been done in connection with the life history of this insect in Queensland.

COTTONY CUSHION SCALE.

The name *Icerva purchasi* was given to the cottony cushion scale by Maskell in 1878. Unlike many other species, there has been little or no confusion as to its true identity, and all references to the insect will be found under this name.

Description.

The scale is very distinctive in appearance, and there could scarcely be any confusion with any other species found on citrus. The rather flat young are dark-red in colour, and the body is covered with a yellowish or dirty creamy-coloured cottony secretion. Long delicate hairs are carried on the antennæ and at the anal end of the body. Soon after feeding has commenced four areas of callous-like formation are prominent on the dorsal surface, and similar smaller areas may be seen towards the margins. A long single hair projects from the anal end, and at the tip of this a droplet of clear liquid can generally be seen. The dark hairy antennæ and long legs are conspicuous. As they develop the females become somewhat convex, and the body, which is dark-red or reddish-brown in colour, is covered with a yellowish mealy matter. The body is adorned with a mass of minute hairs which imparts a rather woolly appearance to it. Long delicate filaments project from the margins. When about to produce eggs the adult female secretes an ovisac. This ovisac is composed of snow-white cottony material compressed together, and the exterior is distinctly and regularly corrugated. Ultimately the insect rests on the anterior end of this ovisac in an almost perpendicular position with the posterior end uppermost. The length of the female is one-quarter of an inch. The adult male is of the usual delicate form, but is rather larger than the males of most other citrus scale insects. It is orange in colour, and the wings are smoky.

Distribution and Habits.

Cottony cushion scale is thought to be native to Australia, but it is now distributed throughout the world. It has been recorded as having been particularly destructive in California, South Africa, and New Zealand. The insect attacks many plants, including wattle, rose, grape, figs, and several species of deciduous fruit trees. It is primarily as a pest of citrus that the insect has become widely known. It cannot be considered of any moment as a pest of citrus in Queensland, however, and is not a very common insect on any cultivated plant. It is more frequently brought to notice as damaging roses than for any other reason. Very few orchards in the State harbour the species, and infestations are usually small and generally confined to a few trees only. For the most part the scale feeds on the twigs, and the injury which a few individuals can cause in a short period makes it easily realised why the cottony cushion scale is so feared in other places. Unlike most of the scale insects on citrus, cottony cushion does not become fixed early in life, and the females are found moving about the plant until the time of reproduction.

That the insect is of so little significance in this country is due to a very great extent to the wonderful degree of control exercised by its natural enemies. If for any reason these natural enemies are temporarily absent from a locality the insect quickly asserts itself. Fortunately, however, such absences are very rare, and as both the coccid and its most effective natural enemies are native to the country, or at least have been here for a very long period, there is no reason for anticipating that the present status of the insect will change, and cottony cushion scale will almost certainly remain of very minor importance as a citrus insect in this State.

Life History.

The life history as recorded in what follows was compiled from data obtained from rather a small number of insects. It is very difficult to breed the insect under natural conditions, as the abundance of predators and parasites continually reduces the number from which significant data can be obtained. However, observations in the field support the evidence obtained in experimental work.

The winter is passed in immature stages. Ovisac formation may be commenced as early as the beginning of August, but large numbers of young are usually not observed until late in that month, or even early in September. The females of this brood reach maturity and reproduce again in November or December, most typically rather late in December. The second generation then making its appearance develops during the following three months. At this time of the year ovisac formation may begin about sixty days after emergence. During March a third brood is produced, the individuals of this being the parents of those young found in the following September. The time of appearance of the late summer brood appears to vary somewhat, and young may be found in February, March, or even early April.

SOOTY MOULD.

Sooty mould, fumigine, or black smut, as it is variously called, is so well known and so well described by the vernacular names that no further description is necessary. The tangled mass of hyphæ of the fungus, *Capnodium citri* Berk. and Desm., which produces this familiar black coating on leaves, twigs, and fruit is associated with several species of Queensland citrus scale insects. The fungus grows on a fluid secreted by the insects. This fluid, which is commonly termed honey dew, varies in nature and amount with different species, and thus, though commonly secreted by scale insects, it is only that of certain species which supports sooty mould. The fungus has no organic connection with the plant, but grows on the honey dew and is wholly supported by that fluid. This is fairly generally known by orchardists, and too often it is inferred from this that the tree suffers nothing on account of the presence of the fungus on the leaves and twigs. Leaves are able to function correctly only when they are exposed, and thus a leaf covered by sooty mould may become almost or quite useless to the plant. When the number of leaves so affected is large the reduction in effective leaf surface cannot be ignored.

The greatest objection which orchardists have to the fungus is that it often spreads over the surface of the fruit and thus makes it necessary to clean the fruit before marketing. This involves both extra time and labour, even when the amount of fungus on each fruit is small and can easily be removed by brushing. When the fruit are badly affected, however, the most severe brushing to which the fruit can be subjected without risk of injuring the rind is at most only partially effective. Injury to the rind is frequently followed by infection of the fruit by blue or green mould, and the fruit may thus be lost. A light brushing only should be used, and where this is not sufficiently effective, washing in warm water containing borax or similar disinfectant should be undertaken. A common method employed for the removal of sooty mould is to place the fruit in a barrel partially filled with sawdust and then rotate the barrel. The friction of the fruit against the sawdust acts as a brush. This method is effective, but has many objectionable features.

and care should be exercised when it is used. The commonest fault is to have too many fruit and too little sawdust in the barrel, thus allowing considerable jarring of the fruit. In any case, there is considerable jarring, and only the very firm fruit which is to be sold within a day or two of being cleaned should be treated in this way. The method has very little to commend it except that it is cheap.

The removal of sooty mould by spraying is sometimes undertaken, but it is only on very rare occasions that this should be contemplated. If for some reason it has been impracticable to establish control of the scale pest, it may be possible to obtain good results by spraying for the removal of the smut a little before the crop is to be harvested. This, however, should be used as an emergency only, and it must always be borne in mind that the scale is the pest and the sooty mould merely one of its ill-effects. The cause must be combated in all possible cases.

ANTS IN RELATION TO SCALE INSECTS.

As a general rule, ants will be found associated with colonies of scale insects. In most instances on citrus trees it is the small brown ant, *Pheidole* sp., which is found running about the scales. These ants are sometimes thought to attack the pests, but this is not so, and for the most part the ants are searching for honey dew. In some cases the ants incite the scales to secrete this fluid for their benefit. By removing the honey dew the ants do some good, for they thereby lessen the amount available to support sooty mould. This good, however, is often offset by the harm done in interfering with the work of natural enemies, many of which are minute wasps which would be disturbed in ovipositing or searching for suitable sites for oviposition. In some instances the ants are known to assist the scale insects by distributing them and actively protecting them. On the whole, ants in association with scale insects on citrus are either of little value or actually harmful.

NATURAL ENEMIES.

Queensland must be considered fortunate in respect to the natural enemies of the scale insects of citrus. The great majority of the parasites of citrus scales of proven outstanding value which would be expected to become acclimatised in Queensland orchards are well distributed throughout the State. Many of these natural enemies are indigenous to Australia, and for the most part the remainder have been imported without contemplated assistance and thus without expense. When the large sums of money expended by other countries in the importation of some of these useful insects is considered, the good fortune of this State is easily realised. Whilst it is possible that a number of other species of these enemies not yet found in Queensland would accomplish some good, on the whole there is little justification for expending any money on importing and establishing any of the known useful parasites of any Queensland citrus scales, with possibly one exception. It would appear that in the case of pink wax extended biological control by the introduction of parasites from other countries might be expected to meet with success.

Whilst little active assistance can be given the natural enemies of scale insects by the orchardist, it it within his power to make better use of these friendly insects than is frequently the case. In the first place, there is much needless destruction of these species, both by design and

incidentally. Upon thorough examination, colonies of scale insects are frequently found in which so many individuals are parasitised that any artificial control work would not only be wasted but would lead to the destruction of thousands of the useful species. For this and other reasons connected with control, it is advisable that orchardists acquire some knowledge of the most useful of the natural enemies of their scale pests.

The important natural enemies are of two kinds—namely, insects and fungi. Of the two, the insects are by far the more important in this State, and belong to the following groups:—Moths, ladybirds, lace wing flies, and chalcid wasps.

Moths.

There are a number of moths whose larvæ prey on the scale insects, but the only one which is at all common in most parts is *Catoblemma dubia* Butl. The adult of this moth (Plate 143, fig. 3) measures approximately three-quarters of an inch across the outspread wings. The forewings are brown, with the margin lighter and appearing rather bluish at times. The creamy white larvæ (Plate 143, fig. 1) work beneath a covering web in which are entangled the scales of insects devoured, and other débris. These scales may be so placed on the web that a cursory glance would not reveal any difference between the area where the larva is at work and any other part of the colony. The small brown pupa is enclosed in a cocoon of creamy webbing (Plate 143, fig. 2). *Catoblemma dubia* is a most important enemy of white louse (Plate 145) and circular black scales, and it is also commonly associated with pink wax. The moths appear to be more abundant in dry years than at other times, and in these dry periods remarkable results are sometimes achieved against the two first-mentioned pests. Normally, the grubs are most numerous towards the close of the summer, and thus it is advisable to examine colonies of the circular black scale before fumigating or spraying. As white louse spraying should not be undertaken until late in the winter, the full effects of the moth against this scale are usually apparent some time before artificial control is contemplated.

The remaining moths are similar in general respects to *C. dubia*, but are all of lesser importance. Of these a second species of *Catoblemma* at times effects very material control against species of soft scale in the more inland parts of the State. This is a new species which Dr. A. J. Turner proposes to describe as *C. trigonographa*. The pupæ of this species are enclosed in large, tough cocoons which are commonly found matted together in groups, and generally against the base of the tree at ground level.

Ladybirds.

The adult ladybirds are well known, and their worth commonly recognised. Unfortunately, the occurrence of a few destructive species misleads some growers to suspect other species. There is, however, no ladybird which attacks citrus in Queensland, and all species found on that plant should be protected. For the purpose of rough identification it may be said that all small members of the family and all those which are large and shining are useful. Confusion is sometimes caused by the occurrence on citrus of the beetle, *Monolepta rosæ* Blkb., a most destructive insect to many plants, including citrus. The elongate shape of this insect, however, readily separates it from the more rounded, or at least well-proportioned, ladybirds. Though the adult ladybirds are well

Plate 143.

Fig. 1, Larvæ of *Catoblemma dubia* Butl. feeding on scale insects. Natural size. Fig. 2, Pupa of *Catoblemma dubia* Butl. × 3. Fig. 3, Adult of *Catoblemma dubia* Butl. × 3. Fig. 4, Eggs of the green lace wing fly, *Chrysopa signata* Walk. × 3. Fig. 5, Larva of green lace wing fly × 5. Fig. 6, Adult green lace wing fly × 3.

known, the larvæ are not. These are elongate grub-like creatures, tapering somewhat towards the posterior end, and possessing well-developed legs. Most species are black, dark-brown, or greyish-blue, but the commonest of all, *Cryptolamus montrouzieri* Muls., is covered with a flocculent white secretion (Plate (144, fig. 5). There is little likelihood of mistaking the larvæ for other insects, and a few minutes' observation will usually reveal just what the insect is doing on a plant. The eggs are laid on the leaves as a rule, in clusters of a dozen or more, and these clusters of cigar-shaped, light-yellow eggs are familiar to most orchardists.

Undoubtedly the most useful of all Queensland ladybirds is the red-headed species *C. montrouzieri*. This insect is common throughout the State, and is almost always to be found in large numbers in any orchard. The adult insect is elongate oval in shape, being about one-fifth of an inch in length. The general colour is black, and the head, thorax, and tips of the wing covers are salmon red. The upper surface is clothed with fine hairs. Its larva has been mentioned in the preceding paragraph. The scale insects most favoured by this species are cottony cushion, Pulvinaria, and the mealy bugs.

Two other very important species are *Rhizobius ventralis* (Er.) (Plate 144, fig. 6) and *Rodolia cardinals* (Muls.), although of recent years the latter species has rarely been observed in any numbers. The first-mentioned species, *R. ventralis,* is commonly associated with pink wax and soft scales, and against these pests it does very fine work at times. The adult of *R. ventralis* is oval in shape, about one-eighth of an inch or less in length, with the wing covers shining black and covered with light-coloured hairs. The larva is black on the upper surface. *R. cardinalis* is a very small black beetle with red markings.

Another very common species is *Orcus australasiæ* Boisd. var. *nummeralis* Boisd. It is the larger metallic blue ladybird often found amongst colonies of scale, particularly the circular black. It appears, however, to accomplish very little in the way of effective reduction in numbers, even when many are working. The smaller metallic species very commonly observed on citrus is *Orcus chalybeus* (Boisd.). The female is green and the male blue. It is a most useful species.

Lace Wing Fly.

The green lace wing fly, *Chrysopa signata* Walk., is a very beneficial insect. The eggs (Plate 143, fig. 4), which are creamy white in colour, are mounted on stalks about half an inch long, and the clusters of a dozen or more eggs are found commonly on citrus leaves. The larvæ (Plate 143, fig. 5) are curious creatures, tapering towards both ends. They may be seen wandering about the colonies of scale insects with a mass of empty scales affixed to their backs, thus appearing like a mass of moving scale insects. When fully fed, cocoons are produced by these larvæ, and from these later the adult lace wing flies emerge. These adults (Plate 143, fig. 6) are delicate-bodied creatures possessing two pairs of fine, gauzy, many-veined wings of greenish hue.

Though *Chrysopa signata* attacks many species of scale, probably the best work is done against pink wax. Light infestations of pink wax may be removed, but in general the numbers of the host so greatly exceed those of the lace wing fly that little impression is made on the scale position.

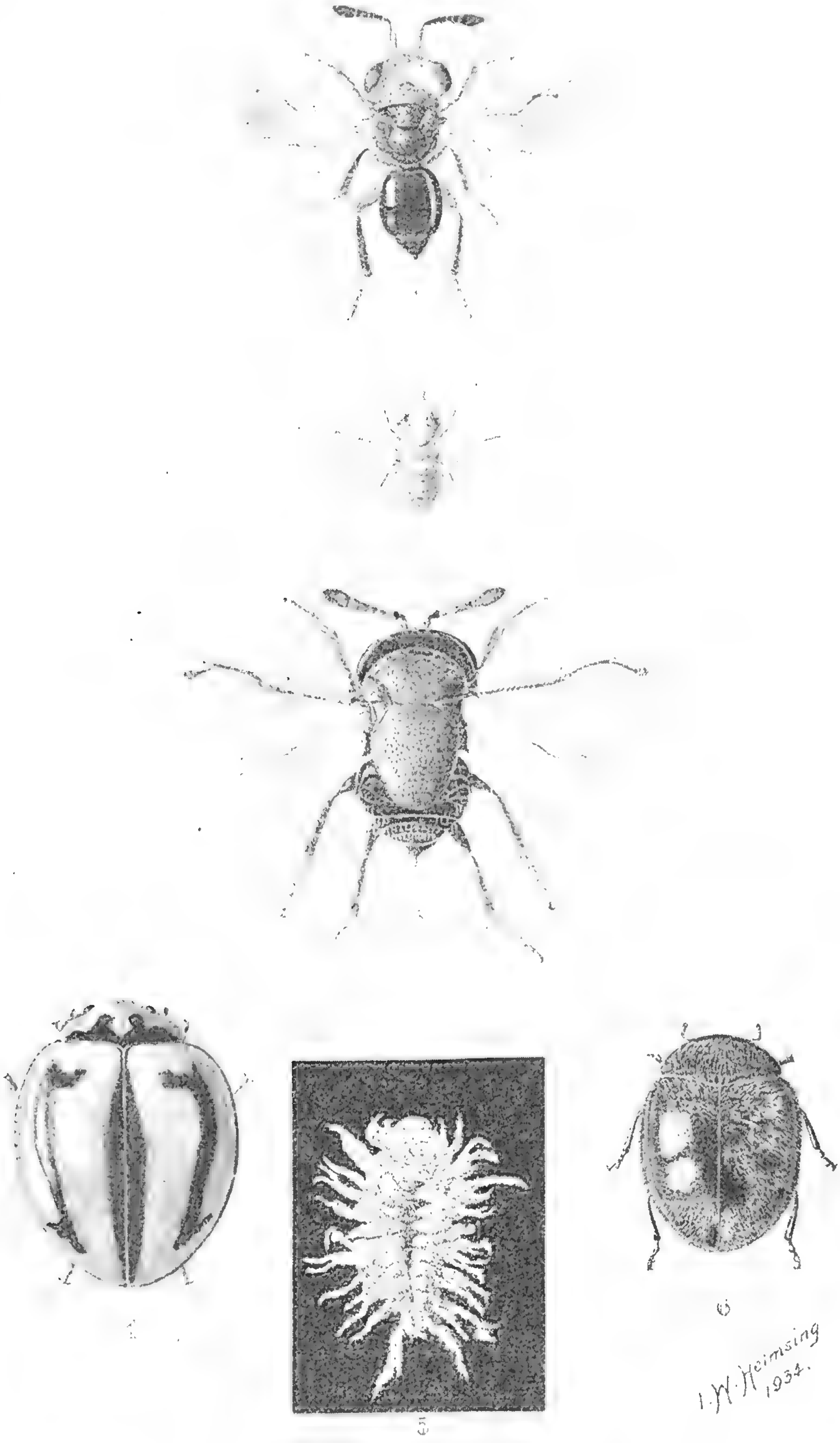

PLATE 144.

Fig. 1, *Tomocera californica* How. × 24. Fig. 2, *Aphelinus chrysomphali* Mercet × 24. Fig. 3, *Scutellista cyanea* Motsch × 24. Fig. 4, *Alesia frenata* Er. × 8. Fig. 5, Larva of *Cryptolæmus montrouzieri* Muls. × 6. Fig. 6, *Rhizobius ventralis* (Er.) × 8.

Chalcid Wasps.

The parasitic wasps of the family Chalcididæ are minute four-winged creatures, rarely exceeding one-twentieth of an inch in length, and are usually much smaller. In comparison with their size they are stoutly built, and have well-developed legs. The forewings are comparatively large. Only a small proportion are native to Australia, but large numbers have been imported accidentally from other countries.

The group contains some of the most important parasites of citrus scale insects. One of the most useful species is *Aphelinus chrysomphali* (Mercet) (Plate 144, fig. 2), the small yellow wasp with conspicuous dark eyes commonly to be seen running about colonies of red and circular black scales. The wasps are particularly abundant in the late summer, and at that time of the year are often so numerous that over 75 per cent. of the red and circular black scales in particular districts are destroyed by them. When, as sometimes happens, this wasp is associated with large numbers of two other chalcid wasps, *Tomocera californica* How. and *Coccophagus iris* Gir., infestations in which every fruit carries thousands of red scales may be completely removed within a few weeks. In addition to attacking the red and circular black scales, *A. chrysomphali* is commonly bred from white louse, but in no case observed has the wasp accomplished results against this species comparable with what has been mentioned in connection with the red scale. *T. californica* is more commonly bred from hemispherical than from any other species of scale. *Scutellista cyanea* Motsch (Plate 144, fig. 3) is one of the most important chalcid enemies of citrus scales. It is very commonly bred from the hemispherical scale, and if old adults of this species are upturned and examined, the whitish larvæ of *Scutellista* will frequently be found devouring the eggs. The adult is the blue hump-back wasp commonly found amongst colonies of this and related species of scale insects. One of the most important of all the chalcid parasites is *Aspidiotiphagus australiensis* Gir. This insect attacks mussel, white louse, and circular black scales, and accomplishes much good at times, more particularly against the mussel scale. This wasp, in emerging, cuts a small round emergence hole towards the posterior end of the mussel scale.

The female wasps of this family lay their eggs in or upon the body of the host scale insect, piercing the scale with their ovipositors in much the same way as the fruit fly inserts its eggs into a fruit. The position into which the eggs are placed and the number of eggs is often characteristic of the species. A grub-like larva emerges from the egg, and after feeding transforms to a pupa, from which the adult wasp is produced. The actual method of breeding varies in different species. Some chalcids, like *S. cyanea* as mentioned above, are predatory on the eggs, and are thus free-living. Others, such as *A. chrysomphali,* the yellow wasp enemy of red and other scales, prey on the body of the scale insect but remain free and feed from the outside though attached to the body of the host. Many others pass the whole of their lives, except the adult stage, entirely within the body of the host. The adults are usually short-lived, and subsist for the most part on sweet juices, such as honey dew.

All species are not equally efficacious even if present in equal numbers. Some, of course, would be expected to be more voracious than others, but apart from this the degree of destructiveness varies. Generally parasites of the scale insect select young individuals in which

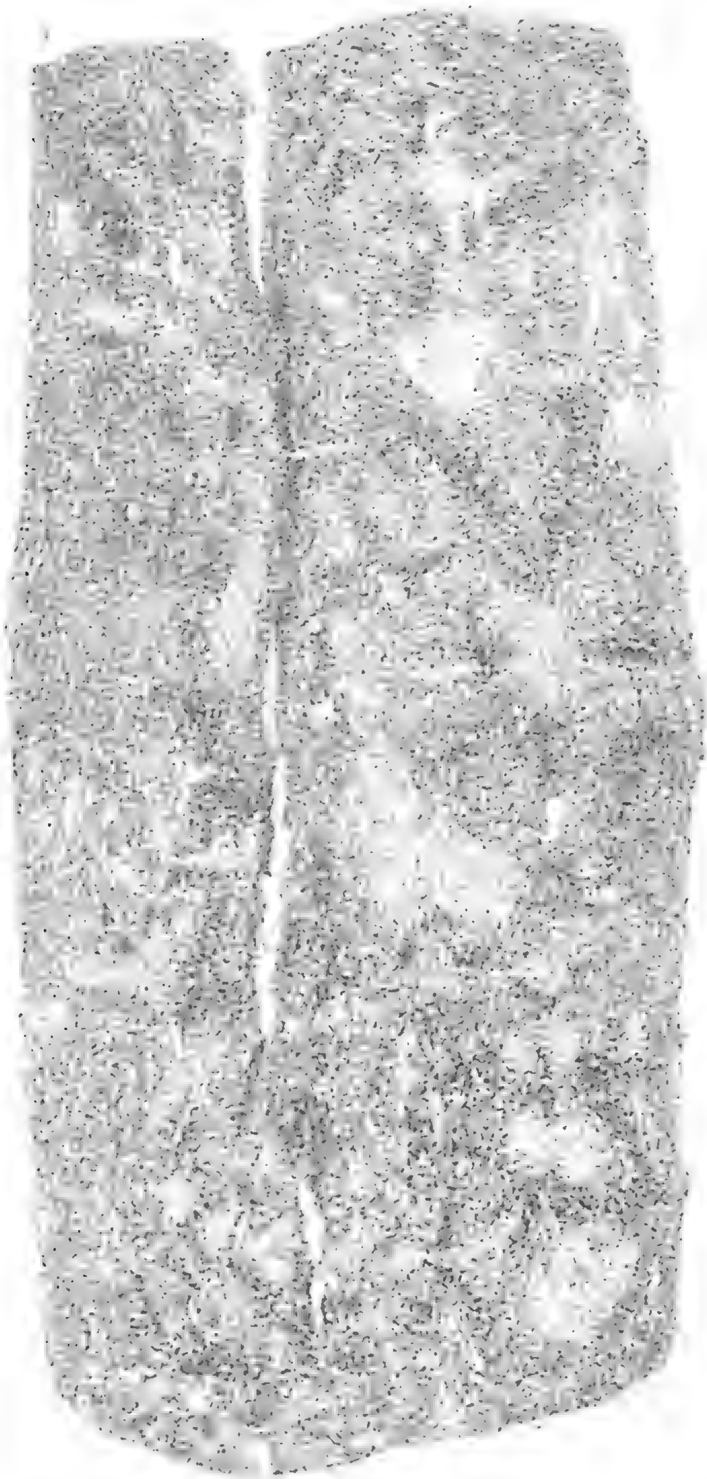

Plate 145.

White Louse, *Chionaspis citri* Comstock, showing infestation on bark. Note predominance of males, presence of cocoons of predatory moth, and splitting of bark.

to oviposit, but in a number of cases those approaching maturity are preferred, which would, of course, be in the interest of efficiency in the case of those species feeding on eggs. In other cases it is found that the female of the scale is able to reproduce to a certain extent before death, owing to the lateness of the oviposition by the natural enemy. The rate at which a parasite develops may also be of importance, for obviously if a parasite reaches maturity very quickly in comparison with the host, there will be perhaps two or even more broods of the useful insect for each one of the harmful species.

When several species of chalcids select the one individual scale as a site for oviposition, it is possible that one or more of the species, instead of confining its attention to the scale, will prey on the other parasites present, and thus a certain degree of efficiency is lost.

Apart from such accidental hyperparasitism, there are many species of these wasps, termed secondary parasites, which are habitually enemies of other species of parasitic wasps. Thus, because a chalcid is found in a scale insect or bred from one, it does not necessarily follow that it is a useful species. The question of hyperparasitism, however, need not concern the orchardist, for if numerous wasps are found operating it must mean that parasites are present and that, in so far as the scales at any particular time are concerned, the position can be summed up without reference to the actual status of each insect.

In practice it is necessary to examine the individual scales and not merely observe the colonies as a whole and the adult wasps seen amongst the scales. With the aid of a hand lens immature parasites can usually be readily made out if of any age, and, commonly, parasitised scale insects show colour variations from the normal individuals. The small hole made in the scale, or the body of the soft species, by the adult parasite on emerging is usually readily seen without the aid of a lens.

Fungi.

Of the fungous enemies of scale insects in this State the red-headed fungus as *Sphærostilbe coccophila* Tul. is often styled, is by far the most commonly found. Though present in all the major citrus-producing districts, this fungus is usually of moment only in the more humid coastal parts. Even in these regions in normal times *Sphærostilbe* cannot be considered a very important factor in scale insect control. In February, 1930, in a large colony of red scale at Palmwoods over 70 per cent. of the individuals were found to be attacked by this fungus. At this time the fungus was much more in evidence than usual throughout the district, but this was a very outstanding case. In normal times 1 per cent. parasitism by this fungus of any host scales is seldom encountered. Red scale is the species most commonly attacked, and against this pest the value is considerably reduced by reason of its reactions to weather conditions being the opposite to those of its principal host. Thus when the scale increases the fungus decreases. It may be thought that the increase in scale is due to the decrease in fungus. Though this is probably so to a slight extent, the degree of control exercised in favourable periods does not suggest that the effect would be very pronounced if the fungus were entirely absent, and this, together with the habits of the scale, deduced from evidence from all parts of the State, suggests

that the increase is very largely independent of the fungus. Pink wax is also attacked by this fungus, and as pink wax infestations increase under circumstances generally found suitable for fungous development, it might be expected that an appreciable degree of control would be exercised in this case. This, however, is not the case, and the proportion of pink wax in any colony, either in the orchard or elsewhere, which is attacked is extremely low. The only fungus which has been found to be of much value in the control of citrus scales in this State is *Cephalosporium lecanii* Zimm. This is at times abundant, and is responsible for considerable reduction in colonies of soft scales. An undetermined species of *Podonectria* is sometimes found on mussel scale, but an appreciable degree of control of the insect rarely results. A species of *Ascheronia* attacks the hemispherical scale, causing it to become very hard and woody, and a species of *Septobasidium* is associated with mussel scale. A number of other fungi have been recorded as attacking scale insects in Australia, but these have not been found during the course of this investigation, and it would appear that they are of little or no importance in connection with scale insects of citrus.

Incidence of Natural Enemies.

Natural enemies, in common with most other insects, are not always present in equal proportions with respect to their hosts. In general, three main groups may be recognised:—

(1) Those natural enemies which are usually present in even proportions and are numerous enough to exercise a definite degree of control. Periods do occur in which insects in this group are rare, but marked fluctuations in populations are very exceptional. The red-headed ladybird, *C. montrouzieri*, is a typical member of this group, which includes most of the ladybirds. The temporary absence of these insects need cause growers no concern, and the situation is almost always rectified naturally within a very short period. In other cases, when an important species is absent for so long that the host scales increase appreciably, supplies of the enemy may usually be obtained from other districts.

(2) The second group contains those insects which annually build the population from small numbers up to a certain maximum. This group includes most of the hymenopterous parasites and the moth *C. dubia*. The latter insect, for example, is comparatively rare in the late winter and early spring. As the year progresses more and more individuals are found until at the end of summer the population may be very considerable, a drop occurring again during the winter months. In most cases the extent to which the useful insects are present is more or less proportional to the strength of the host colonies. This, however, is not an invariable rule. As the natural enemies of Queensland citrus scale insects are widely distributed and thoroughly acclimatised, little can be done to remedy any undesirable position with regard to the insects in this group, and for the most part any absence of a species known to have been in a particular district will be quite temporary.

(3) The third group includes those species which are normally present in small and, for the most part, negligible numbers, or which may generally be entirely absent, but on occasions arrive in very considerable numbers. Such species may at times do wonderful work,

though in general their value is very small. The outstanding example of this group is the ladybird *Alesia frenata* Er. (Plate 144, fig. 4). This insect is ordinarily comparatively rare in citrus orchards, but at times the numbers become so great that the beetles may be seen in layers two or three deep in parts of the tree, and large trees may be so thickly covered that it is scarcely possible to insert the point of a pin between the insects anywhere on the plant. The group also includes a number of species of ladybirds and chalcid wasps.

These three groups are more or less well defined, but gradations will frequently be found.

The fluctuations in populations are brought about mainly by climatic influences or factors which are directly connected with climatic variations. For the most part the natural enemies of scale insects do not confine their attentions to one species of scale, but attack not only several species which feed on citrus, but other non-citrus feeding scales also. The natural enemies, of course, will follow the host scales wherever possible, and thus any abnormal happening such as the destruction of a large area of wild host plants of the scales attacked may be quickly reflected in the position in the orchard.

A list of the natural enemies observed during the course of this work will be found in Table I.

TABLE I.

Natural Enemy.	Most Favoured Hosts.	Remarks.
COCCINELLIDÆ OR LADYBIRDS.		
Cryptolæmus montrouzieri Muls.	Cottony cushion, Pulvinaria, and mealy bug	Probably the most useful scale insect enemy.
Rhizobius ventralis (Er.) ..	Pink wax, white wax, soft brown, and other soft species	A common and most important enemy of many species.
Orcus chalybeus (Boisd.) ..	Red scale and circular black	Common and very useful.
Orcus australasiæ Boisd. var *nummeralis* Boisd. ..	Circular black ..	Common but not generally very effective.
Scymnus notescens Blkb. ..	Pink wax	Very common and most useful.
Scymnus sp. (?)	Pink wax	Minute shining ladybird; very common and useful; may prove to be a *Rhizobius*.
Neda testudinaria Muls. ..	..	Not common.
Platyomus lividigaster Muls. ..	..	Common.
Serangium maculigerum Muls. ..	..	..
Rodolia cardinalis (Muls.) ..	Cottony cushion ..	Does excellent work when in numbers, but not very common.
Alesia frenata Er.	..	See note in text.
CHRYSOPIDÆ OR LACEWING FLIES.		
Chrysopa signata Butl. ..	Pink wax ..	Very good but not usually present in sufficient numbers to accomplish appreciable control.

TABLE I.—*continued.*

Natural Enemy.	Most Favoured Hosts.	Remarks.
CHALCIDOIDEA OR CHALCID WASPS.		
Aphelinus chrysomphali Mercet.	Red, circular black, and white louse	A most useful species.
Coccophagus iris Gir.	Red scale	..
Tomocera californica How. ..	Red, white wax, and hemispherical scales	Very common.
Rhopalencyrtoidea dubia Gir. ..	Red scale	..
Aspidiotiphagus australiensis Gir.	Red, circular black, pink wax, white louse, and mussel	A most useful parasite.
Metaphycus lounsburyi (How.). ..	Olive scale	Appears to be the parasite mainly responsible for the unimportance of this scale.
Metaphycus flavus How. ..	Soft brown	..
Metaphycus varia Gir.	Pink wax and Pulvinaria	..
Aphycus verdini Gir. ..	Soft brown	..
Cheiloneurus sp.	..	Probably a secondary parasite.
Diversineurus elegans Silvestri ..	..	Secondary parasite commonly bred from hemispherical scale colonies.
Parœnasomyia listzi Gir. ..	..	Secondary parasite. Recorded from *S. cyanea* and *T. californica*.
Aphelinus sp.	Soft brown	..
Marietta distonata Gir. ..	..	Thought to be secondary parasite.
Ophelosia crawfordi Riley ..	Cottony cushion ..	..
Coccophagus sp.	White louse	Not common.
Eucomys sp.	Soft scale	Possibly primary parasite.
Tæniomastix abnormis Gir. ..	Pulvinaria	Not common.
Signophora perpauca Gir. ..	..	Secondary parasite obtained from Pulvinaria.
Scutellista cyanea Motsch. ..	Hemispherical and olive scales	An important enemy of these species.
Encyrtis spp.	..	A large number of species, many apparently undescribed, of this genus were obtained, but the exact status of each not determined. Probably many are secondary parasites.
NOCTUIDÆ OR MOTHS.		
Catoblemma dubia Butl. ..	White louse, circular black and red scales	A most important enemy of the first-named scale.
Catoblemma sp.	Soft brown	..
FUNGI.		
Sphærostilbe coccophila Tul. ..	Red and mussel scales	*See* note in text.
Microcera sp.	Pink wax	*See* note in text.
Cephalosporium lecanii Zimm. ..	Soft scales	*See* note in text.
Podonectria sp.	Mussel scale	..
Septobasidium sp.	Mussel scale	..
Ascheronia sp.	Hemispherical scale ..	Fairly common, but of doubtful value as only old individuals appear to carry the fungus to any extent.

ATTENTION TO FACTORS LIMITING INCIDENCE OF SPECIES.

The control of a pest in a commercial orchard may entail much more than killing a large percentage of the pest present at a particular time. Economic considerations demand that the trees remain commercially free of the pest for the longest possible period. With insects such as those now under discussion, which produce rapidly and prolifically, the most effective insecticide may accomplish little towards true control of the pest. In the case of red scale, for example, orchards have been seen in which repeated application of the best known scalicide for the purpose have failed to maintain a control of the pest for more than a few weeks, and where, had the problem been approached from the point of view of the trees, the insect could have been reduced to insignificance in a very short time. The application of scalicides, even at appropriate times, does not constitute the whole of the combative work which can be done against scale insects, and, in fact, in some cases may not form a necessary part of that work.

Growers have always found, and will continue to do so, that the same treatment does not give equally good results against a pest on every orchard or in every year. The explanation of this inconsistency is frequently to be accounted for by the habits of the pest, and not, as is very commonly assumed by orchardists, by variations in the insecticidal materials. If the habits of the various species of scale insect are studied it will be seen that each one thrives under certain circumstances and is of little or no importance under others. Some of these conditions are fixed or cannot be altered at will, but with others the influence can be minimised or magnified to some extent by the grower as he may himself desire. The extent to which a knowledge of the factors can be used in the control of scale insects is rarely recognised, and the first recommendation for the control of all scale pests is for orchardists to become familiar with the habits of the insect and thus be in a position to offset as far as possible influences which tend to increase populations of the pest and assist or create those which discourage the insects.

The nature and manner of working of outstanding factors are included in the discussion on the control of each species, but it is impracticable to include all. The way in which the knowledge of the habits may be applied varies from orchard to orchard, and cannot be dealt with in detail. At all events, growers are in the best position to decide the details of how they will proceed to obtain the desired objective, which is to minimise the number of scale insects which they will have to combat actively by reducing the probability of infestation. It may be a matter of judicious pruning, application of fertilizer, irrigation practice, drainage, or any other point having bearing on the health of the trees. For example, it is known that red scale multiplies most prolifically in hot, dry times, and it is desirable to establish artificial control as late in the summer as possible. When the normal monsoonal rains occur, the application of control measures for this species may be left until late March or even early April. If, however, the rains are delayed or are very light the pest may increase so much that the trees begin to suffer. At times growers fumigate at once to save the trees, only to find that,

owing to the period still elapsing before breeding appreciably slackens, the trees are not commercially clean at harvesting time. However, it has been shown exeperimentally that by extra watering not only are the trees better fitted to carry the scale population but that its rate of increase can be definitely lowered. Thus the control can be delayed until the correct time and a reasonably permanent commercial freedom from the pest established without any great detriment to the trees.

The point to be remembered is that scalicides are often only complementary and not sole methods of combating scale insects.

[TO BE CONTINUED.]

A Blowfly Specific.

A PREPARATION of this description should be an antiseptic as well as a healing agent, and afford some protection to the sheep or lambs, to prevent maggots developing from a future strike. Apart from this, there are the wool scourer and manufacturer to be considered, for much trouble, inconvenience, and actual loss is incurred if the specific applied cannot be scoured out successfully. With a view of coming somewhere near these combined qualities with a mixture fairly reasonable in price, the following is recommended for use:—

Ingredients.

40 per cent. Shell Dieselene Oil or Vacuum 28-38 fuel oil;

55 per cent. herring or cod oil;

5 per cent. cresylic acid;

0.1 sodium arsenite, or 1 lb. to 100 gallons.

For the convenience of making 5 gallons of the mixture, take 22 pints cod oil, 16 pints fuel oil (not more than 875 specific gravity), 2 pints cresylic acid and 1 oz. sodium arsenite.

To Mix.

Place the 22 pints of cod oil in a 5-gallon drum and add the 1 oz. sodium arsenite; shake well, then add the cresylic acid and fuel oil. Should the weather be cold, heat at least some of the cod oil and add the sodium arsenite; shake well, and add the other ingredients as above.

The mixture should be well shaken before using, and shaken up occasionally while in use, and applied with a brush or swab.

The conditions under which the ingredients were purchased allowed the specific to be sold, including the container and freight, at 3s. per gallon.—JAS. CAREW, Senior Instructor in Sheep and Wool.

The Soil Population.*

By H. W. KERR.

A CAREFUL examination of a Queensland cane soil immediately reveals its essentially mineral character. It would be found on analysis that at least 90 per cent. of the dry mass of any such soil consists of disintegrated and decomposed rock minerals, while in most cases this proportion would rise to 95 per cent. However, were a soil nothing more than the altered remains of some ancient rock, it would be quite worthless agriculturally. Such a lifeless, inert mass is entirely incapable of supporting crop growth, and we find that the fertility of the soil is intimately associated with that small residue—some 5 or 10 per cent.—which is not of mineral but of organic origin.

From the earliest times this fact has been appreciated by agriculturists. The earliest writings of which we have record stress the necessity for working into the land farmyard manure or other decomposing crop residues in order to increase its fertility. However, the true function and behaviour of these materials in the soil presented a problem the solution of which was discovered only in very recent times. It was in 1877 that two famous French chemists first demonstrated the manner in which nitrogen is made available to the crop in the form of nitrate; they proved conclusively that this process is effected by a select group of minute organisms which inhabit the soil, and their researches provided the stimulus for a most intensive study of similar reactions which take place in the soil. In the short space of the ten years 1880 to 1890, many new facts were brought to light, which demonstrated most convincingly that the soil possesses its peculiar population of minute organisms; and the work of more recent times has provided us with a clearer picture of their life processes, and the important part they play in soil fertility and crop nutrition. It is the purpose of this paper to trace briefly the manner in which these organisms obtain and consume their food, and the nature of the by-products of their work. Doubtless this subject provides one of the most fascinating chapters of the romance of the soil; and it is one of much greater importance to the agriculturist than is generally supposed.

THE SOIL BACTERIA.

When one speaks of bacteria or fungi, the lay mind immediately conjures up visions of dread diseases of man, beast, or plant, in their many and sinister forms. Yet the number of micro-organisms responsible for visitations of this nature constitutes, fortunately, a very small minority; and by far the greater number of "microbes," as they are popularly known, are the friends of man; they are ever busy in his service, destroying the waste remains of animal and plant life, and without whose aid the earth would be so littered with the corpses and plant remains of bygone centuries that life as we know it would be quite impossible. The soil is the native habitat of these helpful types. To give some idea of their widespread nature and the immensity of their number, it may be stated that a teaspoonful of rich garden loam contains as many as 100,000,000 of bacteria! Yet each is so minute

* Reprinted by permission from Proceedings of the Fifth Annual Conference of the Queensland Society of Sugar Cane Technologists, Cairns, March, 1934.

that when magnified 1,000 times it appears only as a small sphere or rod which is just clearly discernible, and the myriads of these tiny forms of life to be found in an acre of such a soil would weigh a mere 50 lb.

The soil bacteria have been the subject of intensive study for the past fifty years, and it is now known that they are extremely varied both in detailed form and in the nature of the work which they perform. It should be stated, from the outset, that we are not at all interested in their individual shapes or sizes, or in the bewildering names under which they labour. We are interested only in their work, and the relationship of this work to the soil and crop. Suffice it to say that the bacteria constitute the simplest forms of life. Whereas the "bodies" of the higher plants and animals are built up of numerous tissues, each composed of its many individual cells, the bacterium is a "single-cell" individual. That is to say, this organism, composed of one simple cell, is able to perform the essential functions of life for which the tissues and organs of higher forms of life are so specialised. Reproduction is effected by the simple expedient first of elongation of the cell, after which it divides in the centre to produce two individuals. The speed with which bacteria may thus increase in numbers, under favourable conditions, is truly amazing. The entire process of cell division, as it is called, may occupy only a brief half hour, so that if the process were repeated over a period of fifteen hours, it is possible for a single cell to give rise to 1,000,000,000 individuals! It will be evident that natural conditions never allow such excessive multiplication; but this calculation demonstrates how the numbers of active individuals may grow when food supply and other growth conditions are suitable.

FOOD SUPPLY.

It is a difficult matter to decide whether bacteria should be regarded as plants or animals; they possess habits which might cause them to be placed in either category, but they are usually regarded as resembling rather the plant kingdom. We will, therefore, look upon each bacterium as a minute plant, and study its life functions in some detail. Like the higher plants, they must have food for their growth and reproduction; but whereas green plants are able to manufacture their own foods—that is, sugars, starches, proteins, and so on—bacteria are entirely dependent on an outside source for their needs. It is in this respect that we find them of special interest, for they derive their food from the plant and animal residues which find their way to the soil, and it is this process of "decay" or decomposition which we should clearly understand, if we would appreciate the true benefits derived from the work of the soil population.

Now, these plant and animal remains are decidedly complex in their make-up. As the bacterium possesses no internal digestive system, how is it able to deal with the substances contained in the organic matter? Obviously, the food must be brought into solution before it can be absorbed through the delicate cell-wall which surrounds the organism. In point of fact, this is accomplished by the secretion of special "digestive juices" which are able to attack and dissolve the organic matter. Furthermore, all groups of bacteria are not capable of dealing with the same classes of substances, just as we find that the higher animals, for example, are specialised in their food requirements.

DECOMPOSITION OF GREEN MANURE AND TRASH.

As regards the simple sugars—which are readily soluble in water—we find that they are suitable sources of food for almost all types; but as the composition of the organic substances becomes more and more complex, the specialised behaviour of the respective groups of micro-organisms becomes more clearly defined. These facts have a most important bearing on the mode of organic decay in the soil, and to illustrate the point let us consider the decomposition of, firstly, a crop of legumes, and secondly, of a mass of cane trash ploughed into the land. If the green manure crop be turned under when in a succulent condition, it presents a most favourable source of food. The sugars in which it abounds are eagerly devoured by the many soil organisms; the starches and proteins which constitute the bulk of the remainder offer but little resistance to decomposition and the soil population undergoes rapid multiplication due to the favourable food conditions presented. As a consequence, the heavy mass of green matter almost completely disappears in the course of three or four weeks; the only visible remains are the relatively small amounts of woody stems which offer stouter resistance to decomposition, but they eventually break down also under the persistent attack of specialised groups of organisms.

Consider now what happens when a mass of dry trash is ploughed under. This material is notably deficient in the readily "digested" sugars and starches, and is composed to a great extent of the more complex and resistant compounds, whose decay is far less complete, over a given period. There is another point of dissimilarity between these two sources of bacterial food. Like all plants, the bacteria demand a supply of available nutrients (or *plantfoods* as they are often called), if they are to grow and function successfully. As far as possible the bacteria derive their nutrients from the organic matter on which they feed, and with the succulent bean or pea crop they are abundantly provided for in this respect. Trash, on the other hand, is far from favourable, and it must be regarded as a highly "unbalanced" food; naturally, then, the bacteria must seek elsewhere in order to make up the deficit in plantfoods, and they turn to the available supply of the soil. It is usually found that nitrogen and phosphate are in greatest demand, which explains why an application of these nutrients in the available condition (for example, as sulphate of ammonia and superphosphate) effects a marked stimulus in the speed of rotting of a compost heap of moist trash.

It is evident that the trash decomposition will thus result in a temporary depletion of the soil's nutrient supply, and this provides a ready explanation of the oft-experienced fact that the ploughing under of a mass of cane crop residues induces most unfavourable growth conditions for our economic crop, while the rotting is in progress. Eventually, however, the nutrients absorbed in the process, together with those contained in the trash originally, become available once again for crop nutrition; but the temporary evil effects may be most serious, when, for example, the trash from a crop of plant cane is ploughed under at ratooning time. The practice is a bad one, particularly in dry areas, as the rotting process also depletes the soil moisture supply. It is much better to put the trash to good use in the form of a soil mulch, to complete a measure of its rotting on the land surface during the wet season; and when the ratoon stubble is eventually ploughed out, the process is completed in the soil while the land is in

fallow. That a green manure crop ploughed under at this time speeds up the rate of decomposition, is explained by the fact that the legume provides an abundance of available nitrogen for the bacteria which perform the work.

It is thus evident that the nature of the reactions which the soil bacteria carry out depends to a very large extent on the nature of their food supply. But in any case, the net effect of their labours is to reduce plant and animal remains to the simplest state. The end products are largely carbonic acid gas and water, while in the decomposition process the soil nutrients such as nitrogen, phosphate, lime, and potash, are again released and made available for crop nutrition. This in itself is a most commendable service which should earn for the soil population the lasting gratitude of the agriculturist. But there is a further aspect to this process of decay which is of even greater importance in that it confers more lasting benefits on the land.

SOIL HUMUS.

It was stated that most plant and animal tissues eventually succumb to the sustained attack of the "digestive juices" secreted by one or another group of soil bacteria. It should now be added that one peculiar class of plant substance is, however, able to withstand this onslaught in a large measure, and emerges from the attack with but slight modification to its original state. These interesting substances are known as *lignins,* and they constitute a large proportion of the "woody" parts of plants. As the result of the operations of the soil organisms, the original identity of these tissues is definitely altered, and they emerge as dark-coloured compounds, collectively and popularly known as *humus.* It is scarcely necessary to stress the value of this compound, and its influence on the chemical and physical properties of the soil. It is this substance which is largely responsible for that favourable granular soil structure so characteristic of a rich garden loam; it exercises a profound influence on the moisture-holding capacity of the soil, and confers on the land a marked degree of drought resistance. Whereas a sandy soil is capable of retaining about one-sixth of its weight of moisture, humus is able to hold twice its weight of water. A soil rich in humus does not pack readily in times of heavy rainfall, and a subsequent light cultivation usually suffices to restore it once more to a condition of good tilth. It possesses the power of holding large amounts of plantfoods in a readily available state, in addition to the fact that practically the *entire* nitrogen supply of the soil is a constituent part of the humus*, from which condition it is made available to our economic crop, through the process of slow decomposition effected by the soil bacteria. It is for this reason that a mass of decayed rock minerals cannot support plant life—it is totally devoid of nitrogen, an essential plantfood material.

When the above properties of humus are carefully reviewed, there is no agriculturist who would not agree that this is far and away the most important soil constituent; and it is particularly unfortunate that our Queensland cane soils are extremely deficient in this compound.

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* Strictly speaking, this statement applies to the entire organic matter supply of the soil, and not alone to the more specific class of compound defined above as *humus.*

The reason is not difficult to determine. Our coastal areas are notable for their uniformly high temperature conditions, together with an abundant rainfall. This combination of factors entirely favours the rapid and complete decomposition of organic matter in the soil. Moreover, high annual rainfall also promotes a rapid removal of plantfoods, one of which in particular—that is, *lime*—is of very great importance in fixing the humus in the soil. When this nutrient is lacking, the humus is freely carried away in the drainage waters. This is amply demonstrated by the brown-coloured waters so commonly observed in many of the creeks and swamps of our poorer coastal forest lands.

Under these conditions it is evident that the problem of maintaining the organic matter content of the soil is a serious one, and is associated in no small measure with the rapid decline in fertility which so commonly follows the breaking up of our cane lands. The process of intensive cultivation which accompanies cane production is most favourable in its influence on the rapid depletion of humus. The growing crop profits from the latter process, but it is effected at great expense to the land. It has been stressed repeatedly that green manuring once in four years cannot be expected to contribute markedly to the permanent supply of soil organic matter, valuable though the practice is from other standpoints. The rapid and relatively complete decomposition of a succulent leguminous crop results in the production of but little humus, owing to the low proportion of lignins in its makeup. The only substances available to the cane grower to help him in his difficulty are the residues of the cane crop itself—that is, the oft-abused tops and trash which, in a wet harvesting season at least, are regarded simply as an unmitigated nuisance. The slow and incomplete decay of this material in the soil is a distinct advantage in this respect, and owing to its relatively high lignin content, a reasonable proportion of humus results. Even the consistent conservation of all available trash over a period of, say, twenty years, however, cannot be expected to enrich the soil permanently to the extent of more than 1 or 2 per cent. of humus. But what an improvement this would effect on many of our run-down soils!

OTHER SOIL ORGANISMS.

So much, then, for a brief and totally inadequate description of the economy and life work of certain of the soil bacteria. Nothing has been said of those specialised forms whose duty it is to convert ammonia to nitrates; or of those busy little organisms which are able to abstract the nitrogen gas from the atmosphere, and build it up into forms of nitrogenous compounds which ultimately become available for crop nutrition; or of the species which enters the roots of leguminous plants, where it obtains its supply of sugars for growth, providing in return nitrogen for the requirements of the host plant, the two living in a state of perfect harmony and co-operation. Again, there are those harmful groups of bacteria which thrive in water-logged soils only, and produce compounds which are in the nature of poisons to our economic plants, and dissipate the nitrogen supply of the land. We have said nothing as yet of the fungi, the yeasts, the protozoa which consume living bacteria, and of other minute soil organisms which also play a most important part in the processes of decomposition. Indeed, many of the reactions which have been credited to the labours of the bacteria are in reality the work of these associated forms. However, sufficient has been said to indicate that the "social organisation" of the soil

population is quite as complex as that of the human race. They lead a quiet existence in a state of peaceful contentment while the soil is in its normal state. True, the relative numbers of each class vary considerably with variations in local conditions; but the economy of the entire population is rudely disturbed when a lavish supply of available food is suddenly turned over to them. If it should be, for instance, an application of molasses or other highly available food, the fungi first increase in numbers at a tremendous rate, and permeate the soil mass with their downy, thread-like bodies; as suddenly, the food supply is finally consumed, and wholesale destruction of the fungi results. Their body tissues now serve as food for the several bacterial types, which are temporarily favoured by a wealth of food for energy and growth. They are, in turn, rapidly reduced in numbers when this stage of the decomposition is completed. And so through the successive stages, until finally the plant foods added in the molasses are again made available for plant nutrition, while the soil gains a residue of the difficultly decomposable substances which are produced, or remain following the decomposition, to become associated with the soil humus, and the soil population again pursues the relatively even tenor of its way.

CONCLUSION.

We must, therefore, regard the soil as a *living* system in which the minute forms of life are ever active, and the results of whose interesting reactions are of such vital importance to the farmer. They pursue their labours for twenty-four hours a day, and seven days in a week; yet they demand as their reward only the waste residues of the crop so worthless to the farmer. Surely they must be regarded as his most efficient workers, whose well-being is worthy of closer attention than is usually their lot.

TO NEW SUBSCRIBERS.

New subscribers to the Journal are asked to write their names legibly on their order forms. The best way is to print your surname and full christian names in block letters, so that there shall be no possibility of mistake.

When names are not written plainly it involves much tedious labour and loss of valuable time in checking electoral rolls, directories, and other references. This should be quite unnecessary.

Some new subscribers write their surname only, and this lack of thought leads often to confusion, especially when there are other subscribers of the same surname in the same district.

Everything possible is done to ensure delivery of the Journal, and new subscribers would help us greatly by observing the simple rule suggested, and thus reduce the risk of error in names and postal addresses to a minimum.

Vinca Rosea.

A REPUTED CURE FOR DIABETES.

By C. T. WHITE, Government Botanist.

In the "Queensland Agricultural Journal" for February, 1925, I wrote an article on the reputed value of *Vinca rosea* as a cure for diabetes. The article was reprinted or referred to in many newspapers and magazines, with the result that a big correspondence resulted and the available stock of reprints soon became exhausted.

Since the article was written the plant has gained a great deal of favour, and some rather wonderful accounts of its value as a curative agent have been given to me.

It was Mrs. H. N. Uffindell, of Lower Mitcham, South Australia, who first drew my attention to the use, in South Africa, of the herb Vinca as a cure for diabetes. Mrs. Uffindell, hearing that the plant was a common weed in Queensland, wrote requesting a supply of leaves, and at the same time enclosed a cutting from a South African paper giving the following directions for the use of the plant.

Vinca Treatment of Diabetes.

Each day boil twenty-seven leaves in three and a-half cups of water for fifteen minutes, then strain. Take one cup after each meal; one hour afterwards as much bicarbonate of soda as can be got on a sixpence in half a glass of warm water. Diet consists of all green vegetables, meat three times a day, game, fowl, or bacon for a change, some apples. Avoid ordinary bread.

In South Africa, Mr. E. E. Whyte, the discoverer of the value of Vinca in diabetes, has put up a proprietary medicine termed "Covinca," for which it is claimed that eight out of every ten cases of sugar diabetes will find the use of Insulin and strict dieting unnecessary.

As the plant is a very common weed in Queensland, the following description and accompanying illustration are published for the use of sufferers who may care to make a trial as to the efficacy or otherwise of the plant. It most commonly occurs along sandy beaches, particularly from Maryborough northwards; about Brisbane and more southern localities it is not so common, but may often be seen as a stray from garden culture.

Two varieties or forms occur, the one with pink (the type) and the other with white flowers (var. *alba*); the properties are most probably the same in both.

Description.—A perennial herbaceous plant 1 to 2 ft. high. Leaves arranged in opposite pairs, elliptic in outline, $1\frac{1}{2}$ to $2\frac{1}{2}$ in. long, nearly 1 in. broad tapering at the base to a short stalk of about $\frac{1}{4}$ in. Flowers borne in the uppermost leaf axils; calyx green about $\frac{1}{4}$ in. long divided to about the middle into five narrow lobes; corolla with a slender tube a little over an inch long dividing at the apex into five flat pink or white

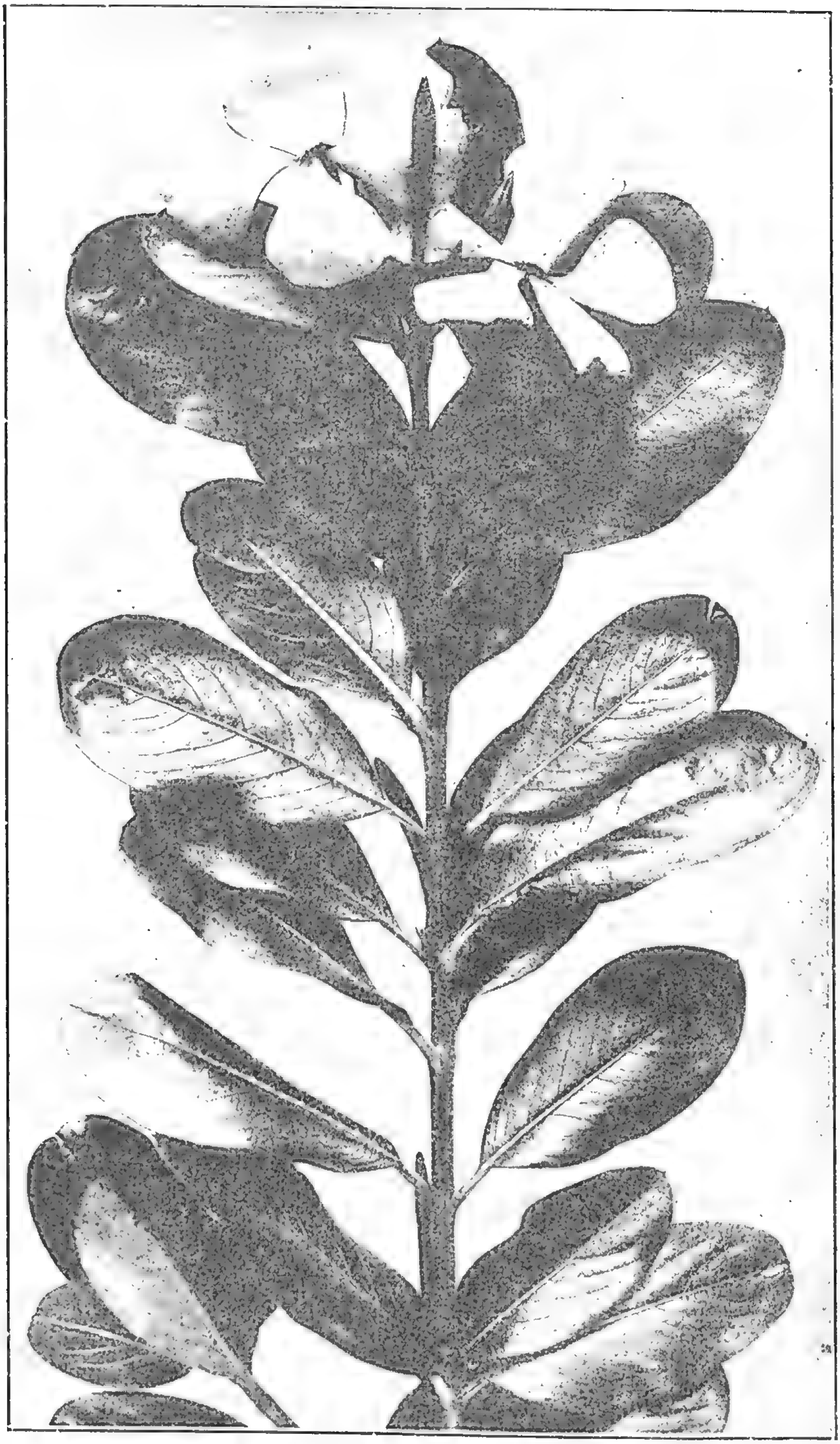

PLATE 146.
VINCA ROSEA, A REPUTED CURE FOR DIABETES.

lobes $1\frac{1}{2}$ in. across; lobes obovate rather lop-sided, much narrower towards the base. Seed capsules in pairs, long and narrow, about $1\frac{1}{4}$ in. long, full of small back oblong seeds, each seed about one line long.

Distribution.—A native of the West Indies and Tropical America, now naturalised in most of the warmer parts of the world.

Common Name.—Species of the genus Vinca are commonly known as Periwinkle.

Botanical Name.—*Vinca,* from the Latin *vinculum,* a bond or fetter, in allusion to the twining shoots of some species of the genus; *rosea,* Latin, referring to the pink colour of the flowers of the type.

Botanical Reference.—*Vinca rosea* Linnæus, species Plantarum 305.

QUEENSLAND SHOW DATES, 1934.

June.

Gayndah, 13th and 14th
Gladstone, 13th and 14th
Wowan, 14th and 15th
Rockhampton, 19th to 23rd
Mackay, 26th to 28th
Laidley, 27th and 28th
Proserpine, 29th and 30th
Townsville Rodeo, 30th

July.

Bowen, 4th and 5th
Gatton, 4th and 5th
Kilcoy, 5th and 6th
Ayr, 6th and 7th
Townsville, 10th to 12th
Woodford, 12th and 13th (Sports only)
Rosewood, 13th and 14th
Cleveland, 13th and 14th
Cairns, 17th to 19th
Charters Towers, 18th and 19th
Caboolture, 20th
Barcaldine, 24th and 25th
Nambour, 18th and 19th
Atherton, 24th and 25th
Esk, 27th and 28th
Pine Rivers, 27th and 28th

August.

Royal National, 6th to 11th
Home Hill, 31st August and 1st September

September.

Enoggera, 1st
Imbil, 7th and 8th
Ingham, 7th and 8th
Pomona, 12th and 13th
Innisfail, 14th and 15th
Mareeba, 20th and 21st
Beenleigh, 20th and 21st
Rocklea, 22nd
Malanda, 26th and 27th
Kenilworth, 29th

October.

Southport, 5th
Millaa Millaa, 5th and 6th
Tully, 12th and 13th

Wheat Varieties in Queensland.

H. W. BALL, Assistant Experimentalist.

IT is considered that wheat farmers will be interested in the relative popularity of wheat varieties grown in Queensland. A census supplied by the State Wheat Board discloses that in 1933 Florence was the most widely grown variety.

Florence has been popular for many years, owing to its ability to yield well over a wide range of soils and climatic conditions. If seasonably sown, it will usually escape rust. Its chief defect is a tendency for the grain to shell in the field when ripe.

To illustrate the changing preference of farmers in recent years the following figures are noted:—

Variety.	Percentage of Total Area Sown from 1929 to 1933.					Area of each Variety in 1933.
	1929.	1930.	1931.	1932.	1933.	Acres.
Florence	11·0	8·64	12·35	14·37	14·95	46,401
*Flora	..	..	1·91	7·18	12·32	38,240
Clarendon	8·9	9·08	16·54	14·07	10·57	32·812
*Three Seas	..	2·4	5·87	6·29	10·51	32,631
Pusa	23·4	28·9	14·47	12·50	9·99	31,023
Gluyas	7·3	6·02	..	6·31	7·93	24,616
*Cedric	7·0	4·85	4·38	6·44	6·83	21,223
Nabawa	..	1·45	..	6·17	4·77	14,715
*Novo	..	3·12	2·09	2·56	3·48	10,800
Cleveland	5·5	..	3·91	3·95	4·37	13,551
Warren	5·6	4·54	3·41	2·57	2·59	8,049
Currawa	8·6	13·74	10·29	2·64	2·27	7,058
*Amby	..	1·68	..	..	1·22	3,780
*Duke of York	..	4·78	..	1·52	1·03	3,198
*Warchief	..	1·17	..	1·05	1·22	3,789
Canberra	..	..	..	..	..	..
Waratah	..	2·67	..	..	..	..
Varieties having smaller percentage than those noted	22·7	6·96	24·78	12·38	5·95	..

* Denotes Queensland bred wheat.

Of particular interest is the fact that the area of wheat sown to varieties bred by Mr. R. E. Soutter, at the Roma State Farm, has now risen to 37 per cent. of the total.

Flora, with 38,240 acres, has moved up to second place. It is a short-strawed wheat of excellent grain quality, which does not shell so readily as Florence when ripe.

Three Seas, a bearded rust-resisting type, is represented with 32,621 acres.

Seafoam, recently released for cultivation, is a similar type to Three Seas but has better quality grain.

The area sown to Seafoam is likely to increase in the near future.

Pusa has lost acreage evidently owing to its susceptibility to damage by frost.

Currawa has also lost ground, and owing to its slow-maturing habit, is now chiefly grown by those desiring to feed off the early growth to sheep.

Nabawa, which is now the leading variety in New South Wales and West Australia, was represented in Queensland with 14,715 acres.

The high proportion of such good quality wheats as Flora, Florence, Pusa, Cedric, and Novo now grown in Queensland is particularly fortunate.

Farmers grow these wheats, not because of the quality but because they yield well under Queensland conditions.

Looking to the future, if production can be continued at a profit, this State should have an export surplus of wheat within the next decade, when our wheats should be more eagerly sought after than the softer wheats grown elsewhere.

GETTING READY FOR MAIZE—IMPORTANCE OF EARLY PLOUGHING.

Deep early ploughing and winter fallow are the most important cultural factors in the growing of maize. Under most conditions this first ploughing should take place in the autumn or early winter. It is almost an invariable rule that, other things being equal, the land that has received the longest preparation gives the best returns. The following results have been obtained from experiments at Grafton Experiment Farm (N.S.W.) averaged over four years:—

	Yield per acre.	
April ploughed	70 bus. ..	21 lb.
June ploughed	62 ,, ..	37 ,,
August ploughed	55 ,, ..	2 ,,

Land ploughed at the period recommended and left in the rough state during the winter is greatly benefited by the mellowing action of frosts, and is open to receive the winter rains, both of which penetrate more deeply into the soil and subsoil. This, with the greater aeration of the soil, materially improves the soil's chemical and physical character, especially if the ploughing be deep and thorough.

Where undulating land is left unploughed during the winter, much of the rainfall is lost by running off the hard surface. Most of this could be conserved if the land were deeply ploughed and left rough. On hillsides and where the winter rains are excessive it may be found advisable to plough the land in autumn and plant a cover crop like peas, clover or rape to cover the ground during the winter and prevent erosion of the soil. In all cases where hillside land is cultivated it is preferable to plough and plant across the slope of the hills in order to save the soil from washing.

On flat lands that drain poorly recourse may often be had to ploughing the ground in narrow strips about 8 feet or 12 feet wide, on which two or three rows of maize are planted, with a "dead" furrow or open drain between each strip to carry off the surplus moisture.

Malting Barley.

TOWARDS the end of 1932, to satisfy a general desire expressed by barley-growers for a change of seed of malting varieties, the Department of Agriculture obtained small quantities from England of the following varieties of malting barley:—Winter Archer, Spratt Archer, and Plumage Archer.

Similarly, the Queensland Barley Board interested itself in obtaining supplies of seed of Plumage Archer from Tasmania.

The three barleys imported by the Department were subjected to analysis on arrival and were placed with two well-known barley-growers at Nobby for propagation purposes. Similarly, the varieties from New Zealand were submitted for analysis and germination test.

Owing to the fact that climatic conditions obtaining during the period of harvesting, or immediately prior thereto, were adverse for the production of a first-class malting barley, the protein and carbohydrate content of this season's barley have been affected. Coincidentally, climatic factors have more or less affected the germination of these barleys. The following tabulated information will give some indication of the change that has taken place:—

——	Moisture.	Protein.	Fat.	Carbohydrate.	Fibre.	Ash.	Germination.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
1932.							
*Spratt Archer ..	12·0	8·6	1·3	71·7	4·1	2·3	98
†Plumage Archer..	14·8	8·1	1·1	68·9	4·8	2·3	80
†Spratt Archer ..	13·7	7·7	1·3	70·8	4·3	2·2	82
†Winter Archer ..	14·2	7·5	1·3	70·3	4·3	2·4	79
1933.							
*Spratt Archer ..	11·1	9·8	1·3	70·2	4·9	2·7	98
*Plumage Archer..	13·6	11·8	1·4	65·7	4·9	2·6	88
†Spratt Archer ..	13·6	12·3	1·2	65·3	5·2	2·4	97
†Plumage Archer..	14·3	15·2	1·2	61·7	5·1	2·5	85
†Winter Archer ..	13·6	12·2	1·0	65·7	4·8	2·7	76

*Ex New Zealand. †Ex England.

It is, however, anticipated that these barleys grown under normal seasonal conditions will show considerable improvement over the results given, and farmers who have grown any of them are recommended to continue their growth for at least another season.

The Selection of Seed Maize.

By C. J. MCKEON, Instructor in Agriculture.

As harvesting is now in progress, and as it is just prior to or during harvesting that the selection of seed for next season's planting should be made, Mr. McKeon's notes on the selection of seed will be of interest to those growers who have pure strains of a high-yielding variety which has proved suitable for their particular locality and who are desirous of obtaining their requirements for the next season's planting from their own crops.—ED.

ANY grower who practices careful seed selection is well repaid for the small amount of extra labour which this entails, and the high quality of much of the maize that is now being produced in the various districts goes to prove that a large percentage of growers are fully alive to this and also to the wisdom of growing only proved high-yielding pure strains.

Growers who have not a pure strain of a high-yielding variety known to be suited to their particular locality, and who are desirous of having them, should be sure that they are getting their seed from a reliable source, otherwise the resultant crops will probably prove to them that the crop from which the seed was selected was grown in close proximity to a different, and probably mixed, variety, and that cross fertilization had occurred.

Growers in closely settled districts frequently experience trouble in keeping varieties pure owing to cross fertilization with other varieties growing on adjoining farms, as a result of the pollen being borne by wind and insects from one crop to another. This can only occur, however, when crops tassel at the same time and a difference of a few weeks between the plantings is sufficient to prevent it from happening. Where this is not possible, owing to advantage having to be taken of suitable rains, and the two crops happen to tassel at much the same time, care should be taken to confine the selection work to the portion of the crop furthest from the other crop, and, if possible, away from the direction from which the prevailing winds blow. Where possible, the field selection should be carried out prior to harvesting and at a time when the ears are ripe enough for picking, but when it is still possible to distinguish between the early and late maturing plants.

Look for Ears of Even Ripeness.

By continually selecting as nearly as possible only ears of even ripeness, the resultant crop will tassel more evenly than if an indiscriminate selection of early and late maturing ears were made and consequently a much better fertilization will occur, the result being well-filled ears.

Where the tasselling extends over too lengthy a period, fertilization, except under unusually favourable conditions, is not as good owing to the fact that the supply of pollen is more limited and many of the plants may have to depend largely on their own supply of pollen for fertilization.

Seed Ripened Prematurely Should be Rejected.

In selecting from early maturing plants, particular care should be taken to see that ripening occurred naturally and was not the result of disease or injury. During the present season, and this applies particularly to some of the coastal districts, many of the crops were more or less affected with maize blight and consequently any badly affected plants will have ripened prematurely and should be carefully avoided. Affected plants are easily distinguished, even when dry, by the peculiar whitened appearance of the leaf. The ears will also be found to be lacking in that firm feel which is typical of a sound healthy ear and the grain will be also more or less pinched and loosely packed.

Insect Injury.

Another common cause of forced ripening is injury by the maize grub, and where this is the cause, it will be found that the grub has bored through or into the shank or core.

Select Seed from Healthy Plants.

Selections should be made only from strong healthy plants with a good root system and from those which are growing in an average stand and not in an isolated or favoured position. A good root system is very important, for a plant with a poorly developed root system cannot withstand drought; it is more easily blown down by the wind and there is also the possibility of the poor development being due to disease.

An ear from a diseased plant will frequently be found to possess a weak, easily shredded shank, and it will also be found that the core at the butt is discoloured and hollow or partly so.

Ears showing any of these signs should be discarded and only those which possess firm shanks which break away cleanly and show a clean healthy pith at the base should be chosen.

Other Important Points.

The height of the ears on the plant is another very important point to be considered. They should be borne at, or slightly below the middle of the plant, for where they are borne high up on the stalk, harvesting is rendered more difficult and the plants will lodge much more readily during wind storms.

Ears with a shank of medium length and thickness which turn down during ripening should be selected in preference to those with a short, thick shank which remain erect. An ear when turned down will shed water more readily and is also less liable to become damaged by birds and insects than those which remain in an upright position, providing of course the husk covering extends well over the tip of the ear.

A good husk covering is very necessary, for it will almost invariably be found that an ear which has the tip protruding is more or less damaged by water or insect attack.

Regarding the number of ears to the plant, it is advisable to select from the plants which bear one good ear and at the most two, providing one of them is of standard size. Otherwise it will be found that the tendency will be to produce several small ears, with the result that the quality of the grain is affected and the cost of harvesting is increased. The points already discussed will show how necessary it is to carry out

the seed selection in the field, if a grower wishes to improve the variety and at the same time retain the desirable characteristics which the variety possesses.

Where this is not practised and the selection work is left until the crop has been picked it will be impossible to tell under what conditions the ears were produced, and many which are produced under most favourable conditions will be selected in preference to others which are only slightly smaller, but which were produced under average or probably adverse conditions. Naturally, those produced under average or adverse conditions would be of much greater value for seed purposes than those produced under favoured conditions.

It is advisable to always select considerably more ears in the field than will actually be required for seed purposes. The final selection should be made in the barn and the ears selected should be of good size, without being coarse, and should also be of uniform type, shape, and colour. They should be cylindrical in shape, except in the case of a few varieties which produce a slightly tapering ear, and should be well filled up to the tip.

The types of dents vary, a few varieties having a "smooth" or "dimple" dent, but the majority of the most popular varieties now grown in this State have a "crease" to a "medium rough" dent. Grain with a "pinch" dent should be avoided, and, although it is usually of good depth, it is almost invariably light and of a soft starchy nature and will never command the price that plump, well-filled maize will. The shape of the grain varies according to the variety; those which produce ears with less than fourteen rows, such as Golden Beauty and Hawkesbury Champion or Golden King, have a slightly round-shouldered, broad grain of medium depth. Those which produce ears with fourteen rows and upwards should have square-shouldered, tightly packed grain with only a very small space between the rows. The grain should be firmly attached and should show little or no movement when pressed with the points of the fingers. Ears with coarse, sappy piths or cores should not be selected, as they dry out slowly and generally show a lower shelling percentage than those with a medium-sized core.

Uniformity is breadth and shape of grain is a very important point, and is one which should be strictly adhered to if the variety type is to be preserved.

The colour of grain differs according to variety, some of the yellow varieties having a bright amber-coloured grain with a rich yellow cap, and others a pale, amber-coloured grain with a light cream-coloured cap.

Whatever colour is being selected, uniformity should be practised and on no account should an ear of a yellow variety, for instance, be selected which shows reddish or white grains. The straightness and evenness of the rows, while being desirable features, are less important than those already discussed, and as long as they are reasonably straight and even and the ears are otherwise desirable they need not be discarded.

The ears should be topped and tailed before shelling, not that the round grains from the tips and butts would not germinate, but because it is impossible to get an even sowing with a planter with seed that lacks uniformity in shape and size.

Before the seed is stored it should be thoroughly dry and quite free from injurious insects.

The quantity of seed maize required for the average farm is not large, and it is quite a simple matter to store the grain and keep it in good condition for the following season's planting. All that is necessary is an airtight container, such as a carbide drum, and, after making certain that the grain is thoroughly dry, it can be placed in this with a small quantity of flaked naphthalene mixed well through it and the lid sealed down. The naphthalene will destroy any moth or insects which may hatch after the grain is placed in the container, and will not affect the germination.

The Irrigation of Tobacco.

By N. A. R. POLLOCK, H.D.A., Senior Instructor in Agriculture.

THE production of bright tobacco leaf is not favoured in districts where growth is wholly dependent on the moisture supplied by irrigation, owing to the adverse effect on leaf quality of the extremely dry atmosphere there prevailing.

In many of the recommended tobacco-growing districts of the State, however, there are times when the application of water will prove of very great benefit if used judicially, either when planting out or later when a check in growth is anticipated through a delayed fall of rain.

Before discussing the crop under irrigation, it is well to consider the effect of the application of water on the soil and its influence on those factors intimately connected with the growth of plants.

Crop Essentials.

For the best growth it is essential that a sufficiency of plant food, soil moisture, air and light should be provided under a suitable soil temperature. It is also essential that there should be no toxic or injurious substances in the soil such as might be added by the application of water carrying deleterious salts, such as sodium carbonate, or sodium chloride, in solution.

As the water available for irrigation in districts suitable for bright tobacco production is remarkably free from such impurities, its use will cause no trouble in the latter direction which therefore need not now be discussed.

Mechanical Effect of Irrigation.

It remains then to consider the mechanical effect of water when applied in quantity to the soil.

When in good tilth a soil is composed of little clusters of soil particles which create a loose, open or crumb structure, thus allowing a ready and deep penetration of roots into the soil, a good aeration and easy entrance of water.

The effect of water standing for some time on the soil, as in furrow irrigation, or when it collects on the surface from extra heavy falls of rain, is to break down these crumbs into their constituent small particles. These tend especially in the heavier soils to pack together and to make the soil relatively impervious.

It will be realised then that irrigation water may have a very marked effect on an essential factor in plant growth, namely, the air

in the soil. When the soil particles are closely packed and a crust or cake forms on the surface, there can only be a very slow exchange between the air of the soil and the atmosphere above. The result of this is that there is insufficient oxygen for proper root development or for the use of those soil organisms that break down organic matter and make plant food available. Further, it may be noted that certain injurious organisms which reduce oxidised compounds to form injurious reduction products thrive in poorly aerated soils. Thus another factor, that of the supply of plant food, is affected. Without the free circulation of air, especially when the soil is saturated with moisture, its temperature is likely to be unduly lowered.

An additional defect in this packing of the soil, unless remedied, is the slow percolation of water in subsequent applications.

It will be abundantly clear from the foregoing that the maintenance of a friable pervious condition of the soil is of major importance when a crop is grown under irrigation. It is an axiom that irrigation and drainage should go hand in hand as without the latter the avoidance of excess in application is not easy.

The maintenance of just the necessary amount of moisture in the soil without interference with the supply of air and light or undue disturbance of the soil temperature should be the objective when applications are made.

Soil Moisture Requirements.

It is calculated as the result of experiments in many countries that the optimum crop growth is made when the soil has 50 to 60 per cent. of its maximum capacity for water satisfied. This is equivalent in an average soil to 2 inches of water per foot of depth. Consequently amounts over that quantity equally with those under it will tend to lessen growth. The amount of water calculated as in the soil when a crop wilts is about 1 inch. This suggests that to bring the soil to its desired moisture content when wilting occurs, an application of 1 inch to each foot in depth is necessary.

An ideal system of irrigation is one that most closely approaches a light shower of rain, when each drop penetrates as it falls without at any time causing complete saturation or allowing water to accumulate on the surface. The expense, however, of installing such a system would probably be prohibitive.

Methods of Watering.

The general method of application for a tobacco crop will be in furrows between the rows of plants which would be grown on hills or ridges.

In application by this method it is advisable to consider the manner in which the water becomes distributed through the soil. Percolation downward and laterally is to be expected, the rapidity of the former and extent of the latter being determined by the looseness of the soil. As a rule percolation downward to at least the depth of the ploughing is much more rapid than that laterally, but it can be expected on most soils with ordinary applications that lateral percolation will allow the moisture to become equally distributed in the soil between furrows and to rise by capillarity in the hills or ridges.

To allow of similar distribution in subsequent application it is evident the soil between hills or ridges should be well broken after each irrigation.

To avoid excess in any one part it is essential that the field should be graded so that the fall would be even throughout the length of the furrows. Implements to secure this will be found in the Buck-scraper, Louver grader, and smoother and leveller, which may be purchased or made on the farm from plans available from the Subdepartment of Irrigation and Water Supply or through the Department of Agriculture.

The length of irrigating furrows will be decided by their fall. With little slope an excess is likely on the first part of long furrows before sufficient water has reached the end. On the other hand too steep a fall will allow of erosion. In general the less the slope the shorter should be the furrow, and the quicker the application.

Damage from Soil Saturation.

The tobacco crop is perhaps more subject than others to damage from soil saturation since excess of moisture inhibits root extension and invites the attack of particular fungi, the effects of which with following bacteria are commonly described as root rots.

On deep sandy soils or where a good drainage is provided, less damage from excessive applications can be anticipated, but here the supply of water beyond a sufficiency can be regarded at the least as a waste of time and money. On soils possessing a somewhat retentive subsoil, or where the particles are so small as to render under drainage very slow, soil saturation is an ever present danger.

The evil effect of saturation on such soils, as previously mentioned, is due not only to the excess of moisture in itself but to the reduction of soil temperature and its action in preventing the ingress of air and light to the soil, all of which factors contribute so materially to normal plant growth.

When to Cultivate.

Cultivation should, as soon as practicable, follow the application of water to the soil not only to allow of its aeration but to check evaporation. The number of cultivations between applications will be regulated by the soil texture, the aim being to secure a loose but not unduly rough surface. Particularly is this cultivation necessary on fine-textured soils carrying a proportion of silt and clay, where a crust forms after rain.

Hilling the Crop.

In tobacco culture it is the general practice arising from years of experience to grow the plants on hills or ridges, and especially is this considered advisable when the crop is irrigated.

The land being well ploughed and the soil brought to a satisfactory tilth, it is advised to throw up hills in the following manner at the desired intervals. A full furrow is turned and when the fertilizer is distributed at the back of the sod so turned another sod from a furrow ploughed in the reverse direction is thrown against it to form a ridge similar to the formation of a crown when a field is cross ploughed. There will thus be two furrows with the ridge between.

Planting Points.

If the soil is not sufficiently moist to allow of planting, a good irrigation should be given to one of the furrows some little time, preferably the day before, the plants are to be set out. This will allow time

for the water to percolate laterally and rise by capillarity in the hill to permit of the roots of the plants, set in the centre line of the hill, being placed in moist soil while that of the surface remains loose and friable. If there has been insufficient rain prior to planting to supply sufficient moisture over the whole field, an application of water in the second furrow is suggested, immediately after planting is completed. It is not desirable to apply water in both furrows prior to planting as the planter will walk in one when setting the plants out.

As soon as practicable, from two to four days usually, after the application of water a deep cultivation should be given between the hills, special attention being given to break the cake or crust formed and to fill in the furrows which carried the water. A further cultivation should follow a week later when the soil should be rendered loose and friable, both on the ridges and between. Subsequent applications of water given in furrows midway between rows of plants will be governed by the rainfall, if any, the porosity of the soil, and the behaviour of the plants which will show a wilting of the leaves immediately the supply is below requirements. It should be noted that the finer the particles and the greater the content of humus and decaying organic matter in the soil, the more is its capacity for the absorption of moisture increased. Deep, slow-draining soils or light soils with a somewhat retentive subsoil will require lighter applications than deep porous sands.

Naturally as the plants develop more and more leaves, the demand on the soil moisture will be increased, suggesting that applications should be heavier or at less frequent intervals.

Great care should be exercised in applying water to the tobacco crop to avoid soil saturation. Irrigation, alternately, between odd and evenly numbered rows, will tend to obviate this danger, as the excess in one can be expected to percolate to the other. It is considered when proper attention is given to cultivation, four or not more than five irrigations should be sufficient to grow the crop. If rain falls at intervals the number will be lessened. After topping a final heavy irrigation should be given without subsequent cultivation. This should be sufficient to carry the crop to the end of the picking.

Cultivation After Irrigation.

Cultivation of the soil after irrigation is imperative to secure good results. Not only does the breaking and loosening of the soil permit a desirable aeration, but the creation of a loose surface or dust mulch retards evaporation of the moisture brought towards the surface by capillary action. The growth of weeds which rob the soil of much moisture is also checked.

Where insufficient cultivation is given more frequent irrigations are necessary. Such a practice is not economical as the cost of production is increased and the value of the product almost certain to be reduced.

When water is applied it is not advisable to use the cultivator until two or more days thereafter, or until the surface is sufficiently dry to allow the passage of a horse without sinking and the soil to break without adhering to the implement. The first cultivation after the plants are set out should be deep from hill to hill without, however, disturbing the soil of the latter, which should be lightly broken with a

hoe or rake if a crust has formed. Disturbance of the soil in the hill to any depth at this stage is apt to interfere with the strike of plants. A second cultivation should be given a week after the first to further fine the soil and to check any weed growth.

If rain does not fall and no weed growth appears, it is not necessary to cultivate again until after further irrigation.

The second and subsequent irrigations should be in furrows midway between the rows of plants.

After about three weeks the plants will have all struck and made growth so that disturbance of the soil on the outside of the hills with the cultivator will be beneficial in that lateral percolation will be assisted.

In the next cultivation some of the soil should be drawn to the hills to enlarge them.

So, after each application of water the immediate cultivation should be to break up the soil and that following to fine the soil and to build up the hills until, at the final irrigation after topping, the plants are growing on "hogbacks" or round-topped ridges with a furrow between.

The depth of cultivation should be deep, 3 or 4 inches in the centre between rows, becoming shallower to around 2 inches as the plants are approached. After the final irrigation when the plants are topped, further cultivation should not be attempted.

At this stage the leaves will be approaching maturity when the lack of aeration of the soil will assist in the yellowing or ripening of the leaf.

As the plants grow the leaves will project towards the centre of the rows to such an extent that the use of the cultivator might be expected to cause damage.

In early morning the leaves will be brittle but after a few hours of sunshine they will become much more supple. If a short spreader is used on the trace chains just sufficient to keep them from chafing the horse's legs, cultivations can be used from about 10 a.m. to sunset without damage to plants until the flower heads form.

During growth the soil immediately around and between plants should be kept loose and open for 1 to 2 inches in depth by the use of hoe or rake. Priming should receive careful attention, leaves showing leaf-miner being carried off and burnt immediately. Destruction of the insect in the larval stage by this means will lower or prevent future infestation.

The objective in setting out the plants on hills in the first place is to promote drainage and to prevent the saturation of the soil, particularly at the base of the plant. The further building up of the hills not only assists in that direction but adds more plant food to the feeding roots which run close to the surface and encourages the deeper lateral roots to spread further and so more readily secure the moisture demanded.

A properly cultivated plant, whether grown by irrigation or otherwise, will not only exhibit a better root structure and be more stable, but will produce leaf of better quality.

Fat Lamb Raising.

By JAS. CAREW, Senior Instructor in Sheep and Wool.*

FAT lamb raising, as combined with agriculture, is an enterprise in which every farmer who has sufficient suitable land available should engage. The holding should contain sufficient good agricultural land to produce the fattening crops necessary for that purpose, and also to provide some reserves during good years in the form of hay ensilage and grain. To back this up there should be a sufficient area of good grazing country to run the flock on at all times, other than when mothering the lambs. Some localities possess distinct advantages for lamb raising, such as a combination of the desired type of country in a suitable rainfall region, congenial climatic conditions, and convenience of situation in respect of railway facilities, markets or abattoirs. Many parts of the Darling Downs, West Moreton, and the Burnett are, therefore, very suitable for an extension of the industry.

Having the land, the next thing is to so improve it that it can be worked conveniently to the best advantage. Fences should be so arranged as to allow for changing or spelling paddocks, with suitable provision for watering. I do not advocate the changing over from an established industry to fat lamb raising, but I do think that there is room for a vast extension without unduly interfering with progress in other branches of primary production. Every farm should be as self-contained as possible, and without sheep many farmers are not getting the best out of their property. The chief reasons why more farmers are not keeping sheep are, firstly, that sufficient provision is not made for running them properly; secondly, that the breed or type first introduced is not suitable to the country or conditions; thirdly, that the health of the sheep is not sufficiently safeguarded, or that the country is not suitable to maintain health; and fourthly, by depredations by dogs.

The Foundation of the Farmer's Flock.

For fat lamb production a suitable breeding flock is necessary, and herein many different opinions prevail. For best results in production, a good type of ewe of the English long wool—half-bred Merino cross takes pride of place, and should be selected according to the cross most suitable for the district. For the heavier rainfall regions, I consider that the nearer they are to the Romney Marsh the better, while on the more elevated areas and in the lesser rainfall belt such as the Darling Downs, I give preference to the Border Leicester cross in the breeding flock.

The Border Leicesters carry a large carcass, are clean on the head and points, quick to mature, good milk producers, handy to handle, and produce a fair weight of good quality crossbred wool, for which there is usually a ready sale. They cross successfully with the different Downs breeds, the progeny being good growers and fatten at an early age, their chief disadvantage being that they do not mate successfully

* In a radio broadcast from Station 4QG.

during the spring or early summer. Like the other English long-wool breeds they mate best in the autumn.

It is difficult in Queensland to secure a good line of crossbred ewes to form a breeding flock, therefore they will need to be bred up. This can be accomplished by securing the desired number of western bred Merino ewes of the plain, large-framed type. These will be all the better if they are 6-tooths, which have previously reared a lamb. By mating these ewes with the Romney Marsh or Border Leicester rams, according to the location, the ewe progeny can be retained for breeding purposes. After sufficient lambs are reared to form the breeding flock, and while the ewes are still capable of being fattened they should be disposed of as fats and not allowed to become broken mouthed and decrepit. A sufficient number of Merino ewes should be kept or introduced to make up wastage. After the crossbreds have produced about five lambs they, in turn, should be fattened off, at which time they should command a good price as they possess a good carcass for the butcher.

The Lincoln and their crosses are generally more robust than the Border Leicesters, and will last longer as breeders, but neither they nor the English Leicester possess any particular advantage over the Romney Marsh or Border Leicester to favour their claims in producing a farmer's flock.

Purebred Merino ewes have special claims as a farmer's breeding flock, owing to their adaptability of mating successfully both in autumn and spring, or early summer. It is usually an easy matter to purchase a flock of suitable age and type, which will produce a valuable fleece. Their chief disadvantages are that they are rather scanty milk producers, they do not lend themselves to close farming conditions, and are careless as mothers. The English long wool Merino cross, on the other hand, can be worked conveniently; they are large in frame, strong in constitution, and are good milk producers. All these qualities are important in securing a quick development in the young lambs and assist in getting them off at the earliest possible age.

Although the ewe flock is very important, they do not exert the same influence over the progeny as the sires. It is owing to this influence that we must pay particular attention to both the breed and characteristics of the rams that are introduced.

Market Requirements.

The demand for lambs overseas now is for the young, succulent, plump and of not more than 33 lb. dressed weight, carcass showing plenty of bloom. To secure this type the Downs breeds are likely to produce most of these characteristics, the Southdown and Dorset Horns probably appearing to best advantage. This does not infer that other types of dressed carcasses fall away to any extent in price per lb., such as a prime 38-lb. Border Leicester, which can be secured at or before five months. Whatever breed of ram is used, they should be pure, true to type, and kept healthy.

Even when breeding on proper lines, the only way to secure and place prime lambs on the market is to give them a good start and then

keep them going without a check to the time of trucking. The natural grasses are seldom good enough for the length of time needed to top them off, therefore success in a general way can only be looked for in co-operation with crop production. This indicates that those engaging in fat lamb raising must, be to some extent, agriculturists as well as having a knowledge of sheep husbandry.

Flock Management.

Crops must be timed to come in to suit the fattening period. Those for winter and spring feeding may include oats, wheat, barley, rape, and turnips; while the panicums, millet, and Sudan grass, may be selected for summer and autumn feeding. If lucerne can be grown successfully, it should form the chief supply, as it is one of the best and most economic fodders, but it must have other pastures associated with it as a change.

If the ewes are moved on to good feed soon after lambing, their milk supply will increase, and if marked at from two to three weeks they will not suffer much of a setback, and if sold right off the mother they should carry plenty bloom. At this age they cannot be expected to stand up to hardship and starvation, therefore quick transport, careful handling, and immediate treatment at the works are important factors in avoiding loss and maintaining an attractive carcass appearance. Evenness of type is another point of importance, and for that reason too many breeds or crosses are not desirable.

Lamb Raising Scheme.

Recently the Department of Agriculture and Stock introduced a Fat Lamb Raising Scheme under which about eighty rams of the Border Leicester, Southdown, and Dorset Horn breeds were distributed among over thirty growers, with the intention of encouraging fat lamb production; and, at the same time, securing data likely to be helpful in determining the most suitable breeds and types to produce.

The conditions under which these rams are made available to farmers are that they have free use of them during the time the scheme is in operation, but that the rams remain the property of the Department. The farmer undertakes to care for and have them shorn, and to co-operate with the Department in recording all necessary details. The whole of the progeny is the property of the producer, but a percentage of them are to be consigned to the Brisbane Abattoir, to be treated there and reported on for the purpose of the scheme. Further, the Queensland Meat Industry Board has undertaken to obtain a report from England in regard to their condition and quality on arrival there.

Besides the ordinary method of selling through the yards and the buyer having the lambs treated at the abattoirs for export, they may also be treated on the owner's account for export. In this connection, the following particulars should be observed:—

1. Before sending lamb to the abattoir, producers must book killing space, stating number to be treated and suggesting the most suitable date. The Meat Board will then allot space and notify the producer upon which day the lambs should arrive at Cannon Hill.

2. Producers booking killing space will be expected to utilise it, or, if not required, to notify the Board as long as possible before the date booked for killing.

3. Lamb must be consigned to the Board and full particulars of the consignment furnished the Board.

4. The Board will take delivery of the stock at Cannon Hill.

5. The Board will slaughter, weigh, grade, freeze, and wrap carcasses and, subject to space being available, will provide up to 28 days' free storage at a consolidated rate of ¾d. per lb.

6. For the convenience of producers, the Board will credit the producers with the value of fat, kidneys, tongues, livers and rejects, at market rates and, if desired, will dispose of the skins on the producers' account to the best advantage.

7. The consolidated rate of ¾d. per lb. includes loading aboard steamer at the abattoir wharf. The Board will arrange the shipment and will prepare documents, which the Board will hand to the producers' bankers, or other agents through whose agency they wish the meat disposed of.

8. With regard to the minimum of lamb the Board will treat on owner's account for any one client, it would be advisable from the standpoint of economy to fix a minimum of 250 head, and this would not preclude owners of smaller lots in any neighbourhood pooling their lamb to make the required amount.

9. Lamb will be graded as to quality and weight in accordance with export standards and, unless otherwise arranged, will be branded with the Board's registered brand, and each parcel shipped will be specially marked according to ownership.

10. Insurance of meat while in store awaiting shipment, while in transit, and for a certain period at destination will be for owner's expenses.

Insurance to the United Kingdom and Continent—Rate 30s. 6d. plus 25½ per cent. exchange, equal net 38s. 4d. per cent. This covers from the time the carcasses are passed into the cooling and/or freezing chambers of the abattoir at Brisbane, and continues on board the vessel and in cold stores in the United Kingdom for a period not exceeding sixty days from arrival at destination.

11. Shipping charges.—Freight on mutton 1d. per lb. plus 18 per cent. exchange—1.0915d. per lb.; freight on lamb 1¼d. per lb. less 10 per cent. plus 18 per cent. exchange—1.3275d. per lb.; harbour dues 2s. per ton; bill of lading 2s. 8d.

London Charges.—Port rate, landing warehousing, cartage, pitching and tolls, and including selling commission at 2 per cent. approximate, 0.362d. per lb.

Stock Licks for Sheep.

J. L. HODGE, Instructor in Sheep and Wool.*

FIRST let it be admitted that in certain cases the need for a sheep lick exists, and that its use is economical if scientifically applied. The need for it should first of all be detected in an otherwise unaccountable falling-off in the condition of the flocks, with a generally unthrifty appearance; apart altogether, of course, from drought and parasites.

The ingredients to be used should be determined scientifically by proved deficiencies in the soils, pastures, and waters to which sheep have access.

This may be determined by an analysis of all three. The prescription should then contain ingredients to make good the deficiencies. The greatest proved deficiency in most Australian pastures is in a lack of phosphates. For this reason, the basis of most sheep licks should contain a material to make this good. The days when salt only was recommended as a lick in season and out of season are long since passed, and science has come to the help of the grazier and indicated what ingredients should be used under a certain set of circumstances.

One frequently hears of the excellence of a lick in a certain district, and under certain conditions, but it does not follow that because it has proved beneficial to one flock in the district mentioned that the lick is going to do the same good work somewhere else, and under an entirely different set of conditions. The ingredients used may have been perfectly right in the first instance, and more or less useless in the other case.

Observe the Condition of the Flock.

The main thing to note is the condition of the flock. Carefully observe any falling-off in condition, not attributable to seasonal circumstances or the attacks of internal parasites, and quickly ascertain the cause. In nearly all cases, it will be found that there is some mineral deficiency, either in the grasses or waters to which sheep have access. The ingredients in the lick, scientifically prescribed, should supply this deficiency.

When sheep are drinking from an artificial water supply, such as bores or wells, analysis is an easy matter, but when the same flock has access to other waters as well, such as rivers, lagoons, and surface tanks, the analysis becomes more complicated. It is necessary, however, to ascertain the quantity of salt in the waters on account of the fact that the greater salt content shown the less of that ingredient would be prescribed in the lick. In the case of waters from wells or bores, it is quite possible that no salt at all would be used.

Lick Recommended.

On the other hand, analysis may prove the entire absence of salt. In this case the addition of the required quantity of salt may form, in weight, the greatest bulk in the lick. Under drought conditions, it is often beneficial to add a protein such as linseed meal, cotton-seed meal, or maize meal to the lick. Under the heading of drought conditions

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* In a broadcast from Radio Station 4QG.

comes hungry winter feeding when the pastures are dry and hard. A lick we recommend for such conditions is as follows:—

	Parts.
Nauru phosphate finely ground, or sterilized bonemeal	40
Salt (butcher's quality)	40
Sulphate of iron	4
Epsom salts	4
Linseed, cotton, or maize meal	12

Sterilized bonemeal is to be perferred to Nauru phosphate on account of the fact that it contains not only phosphoric acid which is common to both, but also a protein. However, it is more expensive and the supply is not sufficient to meet the demand.

We would advise graziers to have on hand a supply of the ingredients mentioned, with the object of mixing the lick on the property. Once the object for which the ingredients are prescribed is understood, it should be an easy matter for the sheep man to vary the quantities as conditions for change make their appearance.

The Nauru phosphate or sterilized bonemeal is a necessity, and should always form the basis of the lick, but the salt may be greatly reduced or entirely omitted if the water to which sheep have access is salty. The sulphate of iron is a tonic, and the proportion mentioned may not always be necessary, and the epsom salts, being a laxative, may be either increased for hard scrub or winter feeding or decreased as circumstances dictate.

Taken on broad lines, and under adverse conditions when a lick may be relied upon to do most good to the flocks, the ingredients should consist of phosphates, a protein, a laxative, and a tonic, with the addition of salt, the quantity of which should be governed by the special conditions obtaining at the time.

A Lick Feeder.

The practice of feeding a lick to sheep in open troughs is not to be encouraged; it is wasteful. Besides the risk of loss by rain, the flocks foul the mixture, making it eventually unfit for consumption.

The lick feeder recommended by the Department consists of a V-shaped trough, with a hinged and covered top. There is an aperture at the bottom of the trough which automatically releases the lick. A lick board sufficiently broad for the purposes, is attached to the stand about an inch and a-half below the opening, and at a serviceable height from the ground. A beaded edge is supplied to save unnecessary waste.

Legislation these days makes it compulsory for proprietary vendors to register their licks with the Department of Agriculture and Stock, and to attach a label to each package setting out the contents. Many proprietary licks are on offer. Some are good, some not so good, and some indifferent. The flock master proposing to purchase would be well advised to get the opinion of this Department as to the suitability for his country and particular circumstances. During a good season, the necessity for a lick decreases. This is accounted for by the fact that the pastures themselves are supplying the sheep grazed on them with the necessary minerals and food materials. Proteins are especially plentiful with the early bite or young grass growth. Hence the presence of the materials usually supplied in the lick when the season is adverse.

Beware of Salt Poisoning.

Beware of over-feeding salt to ewes in lamb. There appears to be no doubt that a too-plentiful supply of salt has a good deal to do with what is called lambing sickness, or twin disease, for want of a better name. After half the period of gestation has passed, ewes are particularly susceptible to salt poisoning. It is, therefore, recommended that a great proportion of the salt in a lick should be taken out in the case of the ewes as mentioned.

The lick, as prescribed and containing the salt, may be fed to the dry portion of the flock with safety and advantage.

It should be the object of the flock owner to have his sheep consume from 2 oz. to 3 oz. of a prescribed suitable lick per head per week.

Ewes rearing lambs require more than dry sheep. Weaners and young sheep, too, could with advantage do with more lick than is consumed by the dry portion of the flock.

It is not sufficient that sheep should be placed on grass irrespective of what that grass contains in the matter of proteins and phosphates. It may be a case of malnutrition or practical starvation in the midst of apparent plenty. It is what those grasses contain in the way of tissue, bone, and body-builders which is so important.

Deficiency in minerals and proteins is particularly noticeable on natural grasses during the winter months, even if apparently there is plenty of feed.

It is not economical or necessary that a lick should be supplied all the year round irrespective of seasonal conditions. After good pastoral rains, and when the young pasture is at its highest feeding value, the sheep are naturally supplied with the ingredients which should be in a lick to combat adverse seasonal conditions.

Rule-of-Thumb Methods no Longer Apply.

The days are fast passing when rule-of-thumb methods apply to the care and husbandry of sheep. Imagine what the addition of even half-a-pound of wool per head, brought about by the knowledge of what to do and the care in doing it would mean to both the individual grazier and the State in actual money value!

Graziers sometimes do not detect early enough a loss of condition and bloom in flocks brought about by conditions other than parasites or drought. There is a cause for this loss in condition, and it should be the care of every flock master to ascertain that cause without delay. It will be found in most cases that there is some deficiency in the feed, brought about by the absence of those minerals so necessary to the general health of the sheep.

This deficiency should be detected, and the ingredients required made available in the lick.

It is urged, therefore, that graziers should make themselves fully conversant with the properties of the ingredients recommended in a lick so that they may vary the quantities in accordance with seasonal conditions, to the wellbeing of their flocks and the benefit of their own pockets.

Pig Feeding.

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PART II.

THE most important point to watch in pig feeding is the condition of the stock, for the pork and bacon trades require pigs in a finished, fleshy condition, but not too thin or too fat. The illustrations herein will indicate approximately the right and the wrong condition for porkers or baconers.

It has already been mentioned that pigs require variety in their rations, that at least a portion of their food should be concentrates, that they require both nitrogenous and carbonaceous foods, and that many other factors must be considered in the selection of pig foods.

In the following pages the more common pig foods have been grouped as follows:—(1) Grains and Mill Offals; (2) Protein-rich Concentrates; (3) Dairy By-products; (4) Pasture and Forage Crops; (5) Root Crops; and (6) Miscellaneous Foods. The notes are intended to assist pig raisers in determining the value of each food when used in combination with other foods.

NOTES ON FOODS COMMONLY USED BY QUEENSLAND PIG RAISERS.

(1) Grains and Mill Offals.

Maize.—Maize has a large proportion of digestible nutriments. This is accounted for by its relative lack of moisture and indigestible fibre. The high percentage of carbohydrates brings maize under the class of carbonaceous or fat and heat-forming foods, and as its nutritive ratio is too wide for pigs, maize must be fed in combination with nitrogenous foods. Also, as maize is lacking fibre the addition of some roughage improves the ration.

Maize is also low in mineral content and this lack of sufficient protein and minerals makes it a very unsatisfactory food for pigs unless it is balanced with other foods rich in proteins and minerals. The improper use of maize in unbalanced rations has earned for it a reputation for producing a soft and fat carcass, but it has been amply demonstrated that, when used in complete and balanced rations, maize is one of our best pork-producing foods and its use can be continued with confidence provided its shortcomings are understood.

The quantity of maize used in pig feeding is usually governed by its market value and the price of pork. Approximately 5 to 6 lb. of maize (or its equivalent, as it is not wise to feed maize alone), will produce one pound of dressed pork in good young pigs, or, each bushel of maize should return ten pounds of pork. This knowledge enables the pig raiser to calculate the value of maize as grain and as pork. When maize is worth 2s. 6d. per bushel as grain and dressed pork is worth 5d. per lb. each bushel of maize should be worth 5d. $\times$ 10 = 4s. 2d. as pork. In such a case it would pay the pig raiser to feed all the available maize to good pigs with just sufficient protein-rich foods to balance

the ration. When the value of a bushel of maize is more than the value of 10 lb. of dressed pork, maize should be used as sparingly as possible, and some cheaper carbonaceous food used in its place where practicable.

Maize is one of the most palatable foods for pigs and may be fed on the cob, shelled, crushed or ground, and at times it is harvested by the pigs and eaten off the stalk.

Although American experiments have demonstrated that the increased feeding value of ground maize does not compensate for the expense of grinding, observation here shows that when pigs do not thoroughly chew the whole grain, there is a considerable waste in the excreta, but usually when pigs have been accustomed to feeding on whole maize, either on the cob or shelled, there is practically no waste. If the palatability can be increased by grinding or soaking, then there may be some justification for preparing the grain in this manner.

PLATE 147.

These pigs are not in a finished condition, and require more feeding to prepare them for slaughter either as porkers or baconers.

Wheat.—Wheat is much better supplied with protein than is maize, and the nutritive ratio is much narrower though it is still a little too wide for young pigs. In feeding value, wheat closely resembles maize and it is nearly is palatable as maize. The quality of meat produced from wheat is very satisfactory. Wheat is less frequently used for stock feeding on account of its high average value for human food. Being a small, hard grain, wheat gives much better results if ground before feeding to pigs. Shrivelled wheat usually has a higher protein content than plump grain.

When costly protein-rich foods have to be purchased to balance the grain in the ration, the high protein content is a point in favour of wheat as against maize.

Barley.—Barley is another of the useful grains for the pig's diet; although slightly below the feeding value of maize and wheat, it is palatable and has a reputation for producing an excellent quality meat. Barley requires grinding before feeding to pigs. The nutritive ratio of barley is nearly the same as maize, but its total digestible nutrients are less than those of maize. Its use can be recommended with confidence provided its market value is in accordance with the price of pork.

Sorghum.—Grain sorghums are a much neglected pig food, ranking only a little behind maize in feeding value but seldom used. The hardiness of this crop and its ability to produce grain when maize would fail, deserves the consideration of the pig farmer who would provide a succession of crops for a regular supply of pig feed throughout the year.

Like the other small grains, sorghum grain should be ground before feeding to pigs to get the greatest feeding value, but as the grain can be fed on the heads or even from the standing crop, preparation by grinding will probably not be favoured by most farmers.

Pollard.—Pollard, which is a by-product from the milling of wheat, has its place on the pig farm being very palatable, and usually available at a price to make it worth feeding to pigs.

Pollard contains a much larger percentage of protein than maize, but still it can hardly be classed as a nitrogenous concentrate. Its use in the ration to replace a portion of the grain is often economical, but it must be remembered that pollard is always a purchased food, whereas the grains can be produced on the farm.

A little pollard is very useful in the ration of young pigs immediately before and after weaning. Pollard, although fairly rich in protein is not sufficient to balance up rations of carbonaceous foods as are separated milk or meat meal. Experimental feeding has shown that excessive feeding on pollard produces a soft carcass in pigs, but when pollard is merely used as a supplement to grain, there is little risk of this trouble occurring.

Bran.—Another mill offal, is not such a good food for young pigs as pollard, its fibre content being higher, and its fat and carbohydrates being lower than those of pollard. Bran, however, is a laxative and for this reason it has its use for brood sows about farrowing time, and a bran mash is often given to pigs which are in ill-health, and need some food which will stimulate the bowels.

(2) Protein Rich Concentrates.

Meat Meal.—Meat Meal, which is sold under various trade names, is a by-product from meatworks and abattoirs that should become one of the most valuable foods to the Australian pig farmer. It is a nitrogenous concentrate containing a very high percentage of digestible protein and can be put to excellent use in balancing some of the common carbonaceous and bulky foods.

The Australian pig raiser relies to a great extent upon separated milk for his supply of nitrogenous food to balance the grains, &c., and on account of our climatic conditions the supply of milk products is very irregular, and in most years there is a period when the supply is too low to maintain a full supply of pigs; it is on occasions such as these

when meat meal can be put to good use as a substitute for milk products, thus keeping up a regular supply of pigs throughout the year.

Being a highly-concentrated food as well as being rich in protein, meat meal is a valuable addition to a ration containing a large proportion of roughage. The composition of meat meal varies somewhat—particularly the protein content. As some brands of meat meal contain a proportion of bone, their mineral content is comparatively high. Meat meal is made from waste meat which is free from disease, and is cooked under steam pressure and then dried and ground to a fine meal. It is therefore free of disease-producing organisms and can be fed to stock with safety.

PLATE 148.

These pigs are long and lean, but they appear to be sufficiently finished to dress well.

Pigs can be satisfactorily grown on grain and meat meal without the use of milk when each pig receives ½ lb. of meat meal daily from weaning to baconer stage and as much grain as it requires, which will be about 4 lb. for each 100 lb. live weight. Feeding the fixed amount of meat meal right through and just increasing the grain, automatically widens the nutritive ratio as required.

When pigs have access to protein-rich pasture such as lucerne, the meat meal allowance may be reduced to ¼ lb. daily.

Meat meal costs approximately £10 per ton (the price varies very little). While this price may seem high, when it is remembered that meat meal is very rich in protein and only a very small amount (about 4 oz. to 8 oz. daily per pig) is required to balance the grain in the ration, it will be realised that its use at the right time is economical.

When dealing with maize it was mentioned that that grain was low in protein and minerals, therefore, the special value of meat meal, which is rich in these two nutrients, lies in its suitability for balancing a ration containing maize.

Meat Meal may be fed either wet or dry; when fed wet care should be taken so that there is no residue in the trough to putrify and become offensive in odour and dangerous to the pig. It is a palatable food and is relished by both young and old pigs.

American experiments have demonstrated that for balancing grains a supplementary mixture of two parts of meat meal, one part of linseed meal, and one part of lucerne chaff or meal by weight, is superior to meat meal alone.

Linseed Oil Meal.—Linseed Oil Meal is a protein-rich concentrate which can be used in a similar manner to meat meal. It contains less protein than meat meal, but nevertheless it is a highly nutritious food and has a laxative action on the animal, and therefore it is a valuable addition to the ration when an animal is inclined to become costive.

When used as the only protein-rich supplement to grain, linseed meal does not give such good results as when it is used in combination with supplements such as separated milk, buttermilk, or meat meal.

On account of its laxative action the addition of linseed meal to the ration of sows at farrowing time is a wise practice. The fairly high percentage of oil in this food makes it suitable for feeding to stock which are being prepared for show, giving them a glossy coat. Oily foods should be fed with care as their excessive use tends to produce a soft, oily carcass.

Cottonseed Meal.—This by-product of the cotton seed is a nitrogenous concentrate with a very narrow nutritive ratio. The use of cottonseed meal for pig feeding has been limited because in some cases it has been found to produce poisoning when fed in a fairly large proportion over a lengthy period, although recent experiments, both here and in other countries, indicate that at least half the protein supplement of a ration may consist of cottonseed meal provided it is fed in conjunction with meat meal and mineral matter.

(3) Dairy By-products.

Separated Milk.—Although strictly speaking a nitrogenous supplement for carbonaceous foods such as grains, separated milk is used in Australia very often as the basis of the ration, or as the whole ration, and to a large extent the supply of prime baconers and porkers is dependent on the supply of separated milk.

Separated milk contains no fibre, but about 90 per cent. of water. It is one of the most palatable and nutritious foods for pigs and is unsurpassed as a nitrogenous supplement, being even a little superior to meat meal as a sole supplement to grain. Pigs of all ages relish separated milk, and being rich in minerals, it is particularly valuable for growing pigs and breeding stock. Being produced on most farms where pigs are raised, separated milk will be the cheapest nitrogenous food for pigs, and when there is ample supply available there is really no need to purchase other nitrogenous concentrates to balance up the grains and other carbonaceous foods.

The high water content and the narrow nutritive ratio of separated milk make it unsuitable as a sole diet, and it is best fed in combination with carbonaceous concentrates such as grain and fibrous foods such as pasture. The amount of separated milk required to balance maize in the pig's ration depends on the age of the pig which determines the nutritive ratio required; for example—the younger the pig the narrower the ratio required as a larger proportion of protein is required for growth in the earlier stages of life than when the animal is approaching

maturity and wants more nutrients for producing energy, heat, and fat. If young pigs receive a minimum of three-quarters of a gallon of separated milk per head daily from weaning to baconer stage, they will be receiving sufficient protein from the milk to balance all the grain they can eat. By feeding a constant amount of milk—three-quarters of a gallon daily—and increasing the grain as the pig grows, the correct balance of proteins and carbohydrates is maintained. When just sufficient separated milk is used to balance the ration, the greatest value is being gained from the milk, and the feeding of greater quantities results in a loss of nitrogen from the protein of the milk (only the non-nitrogenous portion of the protein being used to make fat) but there are occasions when milk is available much more cheaply than carbonaceous foods and then it may be more economical to use larger quantities of separated milk. On most Australian dairy farms the separated milk supply is so irregular that excesesive quantities have often to be given to pigs in order to dispose of it, irrespective of its feeding value.

PLATE 149.

It is apparent that these pigs have been carried on until they are slightly too fat to give lean, fleshy carcasses. They should have been marketed at lighter weights or given a more limited ration.

Separated milk may be fed fresh or soured. When it is held in vats to sour and thicken, care should be taken not to allow it to putrefy by holding in filthy containers or by holding for too long a period. The ultimate gain from using soured milk is very little if any, and if the milk is fed fresh after the froth has been removed, quite satisfactory results will be obtained. If large amounts of froth form in the pig trough, the pigs may suffer from a form of digestive disorder (wind) which may end disastrously.

Milk, besides being an excellent food for animals, is an excellent medium for the growth of bacteria, hence care should be taken to have the milk free of disease-producing organisms. Milk and its products which come from a cow suffering from tuberculosis, are a common cause of infection in pigs which receive this milk in a raw state. The milk from one tubercular cow may infect all the milk with which it is mixed, and so pigs drinking any of this milk in an uncooked state would be liable to infection.

Unless milk products come from cows that are certified as tubercle-free by a competent person, it is advisable to pasteurise or scald the milk before feeding it to pigs. This is recommended because it is well known that the tubercle germ is destroyed if held at a temperature of 155 deg. Fahr. for twenty minutes or at 180 deg. Fahr. for five minutes. Therefore, all doubtful milk should be heated to these temeperatures as a safeguard against infection of pigs. Heating milk to these temperatures is a fairly difficult problem on the average farm, but there are heating appliances manufactured for this purpose and some farmers are using same with satisfaction.

Buttermilk.—Buttermilk, which is the residue from the cream during the process of buttermaking, is almost identical in composition and feeding value to separated milk, but the buttermilk supplied by butter factories to pig raisers is usually more or less diluted with wash water from the churns, and, of course, its feeding value is reduced according to the amount of water added.

In Queensland the buttermilk from factories is disposed of in varying ways; in the majority of cases a contract for a period of several years is entered into by a farmer to take delivery of the buttermilk and sometimes wash water, from the factory, and the price is calculated either at so much per 1,000 gallons of buttermilk, or at a certain price per annum. The buttermilk is either conveyed through pipes or carted to the pig farm, which should be situated fairly convenient to the factory. At other places the buttermilk is sold to a number of the factory's suppliers at so much per gallon, and it is carted away by the purchaser. Prices paid for buttermilk vary considerably, but the average price is about 10s. to 12s. per 1,000 gallons of buttermilk. At this price, buttermilk would appear to be a cheap food, but when one considers the cost of carting the milk or maintaining a pipeline of about a mile from the factory to the farm, it will be realised that there is more than the actual purchase price in its total cost.

The troublesome feature about buttermilk taken by contract from a factory is the change of seasonal conditions which causes very rapid fluctuation in the buttermilk supply, and as the pig farmer has to keep sufficient stock on hand to consume all the buttermilk that will come in the summer flush period, it will be realised that he cannot at all times feed just sufficient buttermilk to balance the ration, and as pointed out in the notes on separated milk, when more milk is fed than sufficient to balance the ration, the value of the milk is reduced considerably.

Bearing in mind the relatively low cost of buttermilk, the feeder must make the most use of it, as it is doubtful if he can supply any other food at such a low cost, but at the same time, buttermilk, and particularly when it is diluted with water, does not contain sufficient dry matter and has too narrow a nutritive ratio to produce the best results in the pigs, and, therefore, it is best fed in combination with concentrates and forage crops or lucerne hay; but the amounts of these other foods to be fed with the milk must depend on their cost and on the price of pigs.

Buttermilk, like separated milk, may carry the tubercle bacillus and be a source of danger to pigs unless the cream or the buttermilk has been pasteurised. In butter factories pasteurising is done before the cream is put into the butter churns; provided this is carried out

efficiently, that is, if the cream is held at a sufficiently high temperature for a sufficient length of time, there should be no risk of the buttermilk causing infection in the pigs.

Whey.—Although whey is sometimes classed with separated milk and buttermilk as a stock food, it is really in a class of its own. During the process of cheese manufacture, of which whey is the by-product, a proportion of the protein in the form of casein is removed in the cheese, leaving the whey comparatively low in protein content.

With a nutritive ratio 1:9 whey cannot be called a protein-rich food, but, nevertheless, it has its place in cheese-making districts, and is a very valuable adjunct to rations of gain and forage crops provided some nitrogenous concentrate is used to bring up the protein content of the ration. Meat meal in small quantities is useful for this purpose. Feeding experiments have shown whey to be approximately half the value of separated milk.

As in the case of other milk products, whey should be pasteurised before it is fed to pigs in order to minimise the risk of disease in the stock.

PLATE 150.

These pigs were hand-fed twice daily a mixture of 80 per cent. barley meal, 10 per cent. lucerne chaff, and 10 per cent. meat meal, and given water and green lucerne as well. From 37 to 151 lb. live weight they gained 1.2 lb. daily, and made good bacon after slaughter, thus demonstrating that pigs can be grown satisfactorily without milk when meat meal is used. Each pig consumed an average of about $\frac{1}{3}$ lb. of meat meal daily.

(4) Pasture and Forage Crops.

Although the pig requires concentrates such as grains or meals for best results, it is naturally a grazing animal and is contented when it has the run of a good pasture paddock where it can graze and partake freely of fresh air, exercise, and sunlight, all of which assist in promoting health and growth.

Pasture is usually a comparatively cheap food, and as its use reduces the amount of other more expensive foods required, the maximum use should be made of succulent, nutritious pastures in pig feeding. While permanent grass pastures are useful, a larger bulk of food per season and more palatable food can be provided by cultivated crops.

A considerable saving of labour is effected when the pigs are allowed to do some of their own harvesting, and in this respect the "hogging down" of maturing maize crops provides pigs with the grain requirements of their ration, with a saving of the labour required in harvesting the crop by hand.

Pigs running on good grazing land have less chance of suffering from deficiency of necessary nutrients than pigs which are confined in bare yards or pens and hand fed. The rotational cultivating, cropping, and grazing of pig paddocks helps to maintain the fertility of the land and provides one of the most practical means of controlling diseases and parasites—particularly kidney worms and round worms, which cause serious losses to the pig industry.

It has been pointed out that the greater part of the protein in a plant is present in the young growing portion, and as a large amount of protein is required by pigs, the pasture crops are best fed off when they are young and rich in protein; also at this stage, the crops are more succulent and contain less fibre, thus making them more valuable as pig food. While cattle make fair use of mature grazing crops, pigs make much better gains when fed on crops which have not reached the stage of maturity.

While there are advantages in providing annual crops for pigs, permanent grass pasture is sometimes necessary about the piggery. A mixture of summer-growing and winter-growing grasses with some lucerne or clover makes the best permanent pasture, but some grasses on their own provide good grazing. Perhaps the most outstanding single pasture grass for pigs in our Queensland pig-raising districts is Kikuyu grass. It is a vigorous grower, and when well established stands heavy stocking. The nature of its growth enables Kikuyu to withstand a lot of rooting and tearing about which pigs give a pasture. It is palatable and nutritious and will thrive in a wide range of climatic conditions.

Pigs sometimes do a lot of rooting and destroy a good deal of pasture, and to check this habit they should be removed to another paddock or the snouts should be cut or a ring inserted in the snout to prevent the pigs from rooting. Once pigs have learnt to root, it is difficult to stop them, but a good deal of success has been achieved where young pigs have the top cut off their snouts when they are about six weeks old.

While a good deal of damage may be done by pigs rooting up a lucerne or a paspalum paddock, in many cases the rooting does good; in fact, pigs have proved themselves good pasture renovators on matted paspalum paddocks which required breaking up.

Lucerne.—When one thinks of forage crops he must first consider lucerne which is one of the best all-round stock foods. Although it is still a fairly common idea that lucerne will only grow on deep, rich alluvial soils, it has been demonstrated that this crop will grow with varying amounts of success on a very large range of soils, both on the lowlands and the highlands, provided sufficient care is taken to establish

it properly; the ground should be in sweet condition, well cultivated, free from weeds, and containing ample moisture before the lucerne is sown. Once the stand is established it should be grazed and cut with intelligent care and cultivated and top-dressed as required.

Pigs are severe at times on a lucerne crop, and care should be taken so that they will not destroy the stand; they should be grazed for short periods only, then the lucerne should be mowed. The young growth of lucerne—before it commences to flower—is much more palatable to pigs than the more mature crop, of which the pigs eat very little stalk.

Lucerne, like all other legumes, is rich in protein and minerals, and, therefore, valuable for young pigs and breeding stock. It is palatable and readily eaten by pigs of all ages. Young, succulent lucerne, has a slight laxative action on the bowels and so helps in maintaining the animal in health. Good quality lucerne hay that is not too stalky makes excellent roughage for pigs; although it must only be fed in limited quantities to young stock, breeding sows can be maintained in good condition in lucerne hay with a small amount of grain. Pigs do not always appreciate lucerne hay for a start, and they may be given a little chaff or lucerne meal, either dry or soaked, and mixed with other foods until they become accustomed to it. The best way to feed lucerne hay is by placing it in a rack where the pigs can take it at will; a trough should be placed under the rack so that any leaf falling from the hay will be collected for the pigs. Farmers who have a supply of maize, lucerne, and separated milk have the material for supplying excellent rations to pigs, and in periods when the milk supply is low a good deal of the protein content can be made up by lucerne hay, which can be stored in a time of plenty.

There have been cases where a yellowish colour in pork—detrimental to the trade—has resulted from prolonged grazing on green lucerne, and, therefore, some caution is necessary in feeding green lucerne. However, it is not definitely known what amount of lucerne is required to cause this undesirable colouring, but we know that pigs are often grazed on lucerne for months and no trouble results. To be on the safe side, the lucerne grazing should be used mainly for breeding stock and weaner pigs, and the other stock might be grazed only for short periods. This yellow colouring, which is due to a vegetable colour, may come from other crops as well as lucerne, and in this respect we can only say to feed all things in moderation.

Cowpeas.—Cowpeas are a leguminous crop like lucerne, but they are annual in growth and therefore not so useful as lucerne which lasts for many years. However, cowpeas often fit in well with the cropping practice of the farm and are a useful crop to grow in pig paddocks. Cowpeas are summer growing and require much the same cultivation as maize. The crop lends itself to feeding off when the foliage is green and the seed pods forming, but not ripe, or when more mature the crop can be made into fair quality hay. The climbing varieties of cowpeas are sometimes sown together with maize when the paddock is to be fed off by pigs. The cowpea vine has a characteristic flavour which pigs do not always appreciate readily. This may be overcome in handfeeding by allowing the plants to wilt in the sun for a time after they are cut and before feeding to the pigs.

Field Peas.—Field peas have a similar use to cowpeas, but they are a winter-growing annual crop and require somewhat the same conditions as the winter-growing cereals. Field peas are a protein-rich crop which can be fed off before the seed pods are ripe, or it can be made into fair quality hay, which, together with the peas, makes an excellent food for breeding stock. Sown with barley, oats, or wheat, and fed off in the young growing stages, field peas provide a nicely balanced pasture.

Field peas and rape fit into the pig paddock cropping system in winter, as cowpeas and soybeans fit in during summer; the cereal crops, of course, can be used, but these protein-rich crops just mentioned should always predominate in the pig paddock cropping.

Soybeans.—Soybeans are a summer-growing legume with a feeding value approximating that of the cowpea or field pea. This crop also makes good green forage or good hay.

Peanuts.—Peanuts may be used as a forage crop for pigs, both the foliage and the nuts being eaten. A common practice is to turn the pigs into a field which has been harvested, allowing them to clean up the nuts which have been missed. Peanuts are highly nutritious, containing more than 40 per cent. of protein and being rich in fat. Peanut meal is available on the market and is a similar food to linseed meal. The peanut meal is the residue after most of the oil has been extracted. A characteristic of peanut fat is that it is liquid (oil) at very low temperatures, and animal fat made up from peanut oil will not harden under ordinary chilling treatment with the result that pork or bacon carcasses from animals that have been fed on large quantities of peanuts are soft and oily and unsuitable for the trade.

Owing to their high protein and oil content, peanuts produce very rapid growth in pigs, and put a bright sheen on the pig's coats, and therefore their use may be advocated for sows and litters up to weaning time, or for exhibition stock, but for porkers and baconers their use is dangerous, and for safety it should be discontinued soon after weaning.

Rape.—Rape is an annual crop which should be sown in March, April, or May, and in normal seasons should be ready for feeding off in two or three months after sowing. The cost of seeding rape is comparatively light and the return from it is usually two or three grazings of succulent and nutritious fodder. When it is desired to crop a pig paddock in the interests of sanitation and worm control, rape will be found a most useful crop.

Rape has not the same feeding value as lucerne, but its nutritive ratio is almost the same and it is classed as a nitrogenous fodder although it is not a legume. It happens occasionally that when young, tender-skinned pigs are grazed on rape which is wet with dew or rain, the rape has an irritating effect on the skin. This point should be watched in feeding rape.

When the rape crop has been practically eaten down with only a few leaves showing on each plant, the stock should be removed until the crop recovers. In this way several grazings can be obtained in a season.

Cereal Crops for Forage.—For supplying green forage quickly in spring and summer, maize is very useful, being a quick grower, and it can be used at almost any stage of growth. If fine stems are required,

the maize may be grown thickly in rows or broadcast. This is a wise practice if it is known that the crop will be wanted as greenstuff for pigs because pigs make much better use of the finer-stemmed young maize than they do of the larger stems.

Oats, wheat, and barley either sown alone or with rape or field peas provide very useful pasturage during winter, and if carefully grazed the feeding period may be successfully extended over several months. These crops should be grazed when they are about 10 inches high for at this stage the plants are more succulent, more palatable and contain more protein and less fibre than they do in the later stages of growth. The grazing should be so arranged that the crop is eaten down quickly and then rested until it is sufficiently re-established for grazing again.

Pigs should be moved from the crop paddock during wet weather if it is practicable, as their tramping and rooting may seriously effect the physical condition of heavy soils.

(5) Root Crops.

Sweet Potatoes.—In many parts of Queensland, sweet potatoes are a great standby for the pig raiser during a dry winter and spring, the crop remaining in the ground or in the barn from the time it is mature until it is required for feeding.

Sweet potatoes are a bulky carbonaceous food which may be used to some extent to replace grain in the ration and to add variety and succulence. About 4 lb. of sweet potatoes are equal to 1 lb. of grain. Where soil and climate suit the crop it is inexpensive to produce and is easily stored. The best means of harvesting in most cases is by turning the pigs into the paddock. It is not only the tubers that are useful as food, but the vines also make good green fodder, although here a warning must be given to the effect that there are on record, cases of prussic acid poisoning following the feeding of sweet potato vines to pigs. These cases, however, are so very few compared with the large number of pigs which are fed on this crop, that the risk of poisoning would appear to be very slight. The feeding of molasses is recommended to counteract any ill-effect from the vines.

When pigs are fed on a fairly large amount of sweet potatoes they should be given liberal supplies of protein-rich foods such as separated milk and meat meal.

Arrowroot (Canna edulis).—The arrowroot grown in the coastal districts of Queensland has a place in pig feeding in those districts on account of its heavy yielding and hardy nature and its ability to stand in the field for a long period before being harvested. Arrowroot is not a very nutritious crop, but it supplies a large bulk of succulent food which pigs relish.

Arrowroot is sometimes harvested and then boiled before being fed to pigs, but when one sees pigs harvesting the crop for themselves and doing very well and wasting very little of the crop, one wonders if boiling is really a wise practice. Although most of the nutriment is in the bulbs of arrowroot, the pigs will eat the tops which are usually very succulent. Arrowroot is a carbonaceous roughage and should be fed in combination with more concentrated and protein-rich foods. When feeding off arrowroot—as with all crops—it is advisable to run a

temporary fence across the block to confine the pigs to a small area until they have harvested it satisfactorily. In this way, the waste can be kept at a minimum.

Mangels.—The particular value of the mangel as a root crop for pig feeding lies in its ability to withstand a dry spring, provided it is well established in the autumn. The growing period is somewhat long, but if sown in the autumn, the mangel should be ready for feeding early in the following summer when other succulent fodders are usually scarce, and if it is not required when fully grown, the crop may be left in the ground for a few months without much deterioration resulting.

Mangels are a bulky, watery food containing about 85 per cent. of water, but they are succulent and palatable and at the same time they supply a certain amount of nutriment in the form of protein and carbohydrates. Like the sweet potato and arrowroot, mangels are a heavy yielding crop and worthy of a place in the cropping system of pig feeding.

Artichokes (Jerusalem Artichokes).—Although the sweet potato takes the place of artichokes in most cases on account of its heavier yielding capacity, artichokes are grown to some extent as a pig food. The artichokes might be expected to give about two-thirds of the yield that sweet potatoes would give, but they have a narrower nutritive ratio than sweet potatoes, being richer in protein and lower in carbohydrate content.

Artichokes are grown in a similar manner to sweet potatoes, except that they are propagated by tubers. If planted in the spring, artichokes should be ready to harvest in autumn, but if desired they may be left in well-drained soils right through the winter before harvesting.

The tubers may be dug by hand or ploughed out or the pigs may be turned on to the crop to do their own harvesting. If hand dug, sufficient tubers may be left in the ground to give a crop in the following season, and if the pigs are doing the job they should be removed before all the tubers have been eaten out and the land should then be harrowed and left to produce the next season's crop. Being a carbonaceous roughage, the artichoke should be fed together with nitrogenous foods and concentrates.

Potatoes.—The ordinary English potato is usually too high in price as a human food to be used for pigs, but there are times when unmarketable potatoes are available for pig food. They are a carbonaceous food of fair feeding value and should be boiled before feeding to the pigs. About 4 lb. of potatoes are equal to 1 lb. of grain as pig food.

(6) Miscellaneous Foods.

Pumpkins.—In practically every pig-raising district of Queensland, pumpkins can be grown with comparatively little trouble, and their usual heavy yields, together with their excellent keeping qualities, make this crop one of the most important for the pig raiser. Pumpkins contain over 80 per cent. of water and therefore are bulky, but they are palatable to pigs and are best fed raw. The seeds of pumpkins contain fair amounts of oil and protein, and they also act as a mild vermifuge (i.e., they expel worms from the digestive tract of pigs) so the seeds should not be wasted, but they should be fed with caution as digestive troubles sometimes occur when excessive amounts of seeds are fed without the flesh of the pumpkin.

The market value of pumpkins is sometimes so high as to make them too valuable as human food to be given to pigs, but on the whole, a large portion of the pumpkins grown in Queensland are fed to pigs. They can be ready for feeding in a good season from December onwards and if stored in a dry, cool place and picked over frequently to remove the rotting ones, the pumpkin supply can be kept up till the following summer.

Pigs relish pumkpins and the crop fits in the cropping system very well and they are useful when fed in combination with maize, milk, and lucerne. Cases of yellow colouration in the pork of pigs fed heavily on pumpkins have been reported, and in this respect care should be taken not to overdo pumpkin feeding with porkers and baconers.

Melons.—Melons are sometimes used as pig feed, but contain about 95 per cent. of water and are therefore not so nutritious as pumpkins which contain about 83 per cent. of water.

Molasses.—Molasses has its uses as a pig food, but unfortunately its value is often over-estimated and farmers expect it to do more than it really can with the result that various dietetic troubles occur in the stock. Molasses contains about 57 per cent. of digestible carbohydrates which are in the form of sugar and its digestible protein is nil. It is therefore a fat, heat and energy producing food, but not a flesh former.

Molasses has a laxative effect on stock and for this reason it is valuable, during dry seasons when succulent green fodder is not available and particularly for breeding sows which are sometimes inclined to become costive about farrowing time. Stock are very fond of molasses once they become accustomed to it, and this high degree of palatability makes it a useful addition to a ration containing less palatable foods. Molasses should only be given to pigs in small quantities at any time, for if it is fed carelessly severe diarrhœa may result.

When grains or other carbonaceous foods are not available cheaply, molasses may be used with success provided it is not overdone; the excreta of the pigs will give a good indication of when the safe limit is reached. Molasses should always be fed in combination with protein-rich foods such as milk or meat meal, as it supplies no protein to the animal.

Garbage.—Waste foods from private house, boarding-house, hotel, shop, cafe, hospital, and home can be put to good use through the pig which will change waste into edible pork with a fair degree of efficiency, and provided the business is properly founded and well conducted, garbage feeding of pigs can be a profitable undertaking.

The composition of garbage varies to such an extent that it is very difficult to say anything definite about its feeding value. Garbage which has been collected and kept fresh until fed to the pigs and which contains mostly bread, meat, fruit, and vegetables, and is free of foreign matter such as soil, cloth, paper, glass, &c., and which does not contain too much water, is a valuable food. Excessive amounts of water, fruit, and vegetables reduce the feeding value of the garbage.

Garbage feeding is usually carried on near to the cities and large towns by farmers who collect the food in water-tight containers either daily or several times weekly, and cart the food some miles to their farm; thus the greatest expense in garbage feeding usually is in the cartage which is done either by motor truck of horse-drawn wagon.

It is a general practice to boil garbage for an hour before feeding it to pigs. This is a safeguard against disease to some extent, and at the same time the cooking increases the palatability of most garbage. During the boiling, any excessive amounts of fat can be removed by skimming. When too much fat is given to the pigs they tend to become soft in the carcass, and so are unsuitable for the bacon curer or the pork butcher.

The addition of grain and green fodder to garbage improves the ration considerably. Weaners do not thrive on ordinary garbage and they should be given other more nourishing foods until they are about 60 lb. weight. Then the change to garbage should be gradual. Garbage containing fish should not be fed to pigs being grown for pork or bacon as the fish flavour is very strong and taints the carcass.

There is always an element of risk in garbage feeding for one never knows when some poison on injurious substance may find its way into the garbage, and result in the loss of a number of pigs. Swine fever may be carried through pigs eating the flesh of pigs suffering from swine fever. Salt poisoning occurs occasionally through brine from pickled meat being placed in the garbage for pigs. Pigs appreciate a little salt, but large amounts cause death.

TUBERCULOSIS IN PIGS.

Tuberculosis is an infective disease to which both men and animals are subject, cattle and pigs being the stock most susceptible to infection. The significance of the disease in the pig has yet to be fully appreciated by farmers engaged in the industry, observes a New South Wales departmental leaflet, which proceeds to impress upon pig-farmers the necessity for strict supervision of their methods of management.

There is no practical method of treatment of tuberculous in animals, it is pointed out, but attention to the following precautions the disease may be kept under control:—

1. As cattle are the main source of infection, the tuberculin test should be applied to the herd and all reactors removed.

2. Do not allow pigs to roam about pastures and pards used by cattle unless it is definitely known that there is no tuberculosis in the herd.

3. All skim-milk and other dairy products should be heated to 180 degrees Fahr. and kept at that temperature for fifteen minutes before fed to pigs.

4. All refuse, slaughter-house offal, and similar food should be boiled before it is given to pigs.

5. In view of the possibility of pigs gaining infection from poultry affected with tuberculosis, pigs should not have access to runs used for poultry.

6. Where tuberculosis is found to be present in the herd, all suspected animals should be slaughtered, and where this is done under qualified supervision the carcasses which have only a slight infection of the head glands will be passed for human consumption, the affected parts only being condemned. The pens should be thoroughly disinfected and limewashed, disinfectant being added to the lime. All litter and rubbish in the yards should be burned and the ground loosened and treated with quicklime.

7. In the case of stud pigs, if tuberculosis is suspected of affecting any of the animals, arrangements should be made to test the whole of the pigs. The reactors could then be removed.

Fresh air and sunlight are great enemies of the tubercle bacillus. Hence pens and sties should be open and airy, and have no damp dark corners to which the air and sun cannot penetrate.

Incubation and Brooding.

By P. RUMBALL, Poultry Expert.

When to Hatch.

ALTHOUGH incubation may be successfully practised throughout the year, the results obtained from the stock reared are not always satisfactory. It is generally conceded that the best months for hatching are July, August, and September. Heavy breeds hatched during the latter part of June and light breeds early in October will, in some people's hands, prove satisfactory. Chickens of any breed, provided the parent stock are in good condition, hatched in February and March also thrive, but unfortunately they commence production during the period of plenty, and generally moult at or about the same time as the chickens that were hatched and commenced laying six months earlier.

Selecting Eggs for Hatching.

Care in the selection of eggs which are to produce the future layers is essential. They need to be selected for (*a*) size, (*b*) shape, (*c*) texture of shell, and (*d*) colour.

Although like does not produce like with any degree of certainty, constant selection to a certain degree will tend to fix the qualities aimed for. Size is undoubtedly an inherited quality and one of the features which have an important bearing upon successful poultry raising. Breeding birds should be selected early in life for size of egg, as it is only by this means that a strain of fowls can be built up which will lay a good marketable egg in their pullet year. The eggs laid by the hen vary in size from day to day. This variation at times exceeds a quarter of an ounce, consequently in the selection of eggs for size it is not wise to make a 2-oz. egg the minimum weight. Aim at eggs which will average about 26 oz. to the dozen as there is always the tendency in breeding for egg size to diminish rather than increase.

Although shape does not materially affect the market value of eggs, a uniform article is desirable for marketing purposes. Misshapen eggs invariably are poor hatchers, and for this reason also should be discarded. In all table-top machines the heat is radiated from above the eggs with the result that there is a greater heat 1 inch above the egg tray than 1 inch below. In some types of machines the difference is as much as 6 degrees. As the embryo of the egg always finds its way to the uppermost surface of the egg it will be readily seen that large eggs will hatch much earlier than small eggs, and that to obtain even hatches only eggs of uniform shape and size should be used.

Texture of shell varies considerably with the feeding and general condition of the stock, but it is also possible for this feature to be hereditary. Apart from this uniform shell structure makes for improved hatches, and eggs with shells of poor texture should be discarded. Colour of shell is not an important feature upon the local markets, but from light breeds white-shelled eggs should be produced and from heavy breeds brown-shelled eggs. It is suggested that no harm would be done by trying to maintain these characters—in fact, with brown-shelled eggs the deeper the brown the better the appearance.

Keeping Eggs for Hatching.

Eggs required for hatching purposes should not be kept for a longer period than ten days. If they were set five days after laying better results could be expected than when they were ten days old. It is, however, necessary to keep them sometimes longer than five days and occasionally even longer than ten, therefore they need to be kept under the best conditions. A uniform cool temperature is desirable, one slightly under 60 deg., if possible. The room where they are stored should be dry and not moist. Although fresh air is desirable, direct currents of air are detrimental on account of the drying-out effect they have upon the egg. A good plan is to store them in strawboard fillers in cases. This prevents, to some extent, the undue drying out of the moisture content and facilitates the daily turning of eggs that are to be retained for any period. All that is necessary is to rest the case every alternate day upon a different side. The necessity of turning is due to the fact that the germ cell always comes to the uppermost surface of the egg, and if left undisturbed would stick to the membranous lining of the eggshells.

Methods of Incubation.

Incubation may be practised either by natural or artificial means. The necessity of having chickens hatched at certain periods of the year and the constant improvement that is taking place in our commercial flocks makes it increasingly difficult for the poultry raiser who desires to keep a 100 or so good-laying hens to use the broody hen, consequently artificial methods of incubation are resorted to by 90 per cent. or more of poultry raisers.

The period of incubation of eggs varies considerably. With hens it is 21, English ducks 28, Muscovy ducks 34 to 35, geese 28 to 30, and turkeys 30.

Natural Incubation.

When the hen is used for hatching purposes she generally finds her own nest. The best plan is to allow her to continue using it, merely protecting her from rough weather and preventing other birds from laying in the same nest. Her eggs, however, should be removed and replaced with eggs which came from the best of stock, failing this there would be rapid depreciation in the productivity of the stock. As she is expected to remain on the nest for a period of three weeks and will not make free use of the dust bath, she should have a dusting with some insecticide prior to the eggs being placed under her and another a few days before the chickens are due to hatch.

Red mite or tropical mite is possibly one of the most common and irritating parasites that trouble poultry. They multiply very rapidly when unchecked, and a sharp lookout should be kept for their presence, for if allowed to infest a broody hen the irritation will often cause her to leave the nest. Scaly leg is also a condition which should be avoided with the broody hen. The scale is caused by a parasite which may infest the legs of chickens very soon after hatching and result in an increasing number of birds with that unsightly leg. Not only is such a leg unsightly, but the parasite is detrimental to the development of the young.

The number of eggs to be set under a hen varies with her covering capacity. She should never have more than she can comfortably sit upon. The broody hen turns her eggs at frequent intervals, and those

in the centre will eventually find their way to the outside of the nest. If the hen has more than she can cover the outside eggs become chilled, and owing to the hen's action in turning the majority would in time become chilled and the embryo destroyed. The hen should be fed exclusively upon grain, and have plenty of dry grit and water before her at all times. The best results will then be obtained by leaving her as much as possible to herself.

A good and economical lice powder may be made up of the following ingredients:—One and a-half pints of petrol, a half pint crude carbolic acid, and plaster of paris.

First mix the carbolic acid and petrol, then stir in slowly the plaster of paris. Only use enough of the plaster of paris to take up all the liquid. Spread the moisture upon paper to dry out, and then store in airtight tins or jars. A small tin with holes punched in the lid is an efficient and economical means of distributing the powder through the feathers of the bird.

Location of an Incubator.

The incubator should be set up in a room where there is as little variation in temperature as possible. If a special room is to be built it should have two roofs with a space of 6 inches to 1 foot between each. The outer roof should overhang several feet on all sides. Such a roof permits of a free circulation of air between them and prevents an undue increase in room temperature by the rays of the sun when overhead, and the overhang protects the walls. If it is found that late in the spring the overhang is insufficient protection from the afternoon sun, a curtain can be suspended to afford greater protection.

Ventilation should be provided by windows and adjustable vents in the inner roof and bottom of the walls. These can be operated according to the number of machines working in the room and the outside temperatures. Direct draughts, however, should be avoided. Where it is not desired to go to the expense of building a special incubator room, an enclosure may be made under the majority of dwelling-houses. If it is situated under the centre of the house it is well protected from the sun and the temperatures are therefore fairly uniform. When the incubators are so situated it is essential that insurance companies be notified.

Heating of Incubators.

The majority of incubators are heated by kerosene lamps. The lamps should be thoroughly cleaned daily, and the burner boiled in water, to which washing soda has been added, after each hatch. New wicks should be used for each hatch. In starting, do so gradually. If a large flame is used when first warming up the machine it frequently leads to smoking of the lamp. A good grade oil is essential, and in adjusting the flame turn it up a little higher than necessary and then reduce to the desired height. This action makes the last pull upon the wick down and guards against a flame running up. Wicks of a correct size are essential.

The lamp should be cleaned and filled early in the afternoon. By doing this at this period all char is removed ensuring the maximum heat from a given-sized flame during the cold night, at the same time the operator has ample time to make the correct adjustments before retiring for the night. In trimming the wick do not use scissors. Rub off the

charred crust with a match and thoroughly clean the hands before handling eggs, otherwise the eggs may become smeared with oil, with the resulting injury to the embryo.

Beginning the Hatch.

Heat up the machine a couple of days before eggs are to be set, and after the machine is thoroughly warmed up commence to adjust the regulator. When the operator is sure that the regulation is correct the eggs may be set. This is better done in the morning so that the eggs will be thoroughly warmed up before nightfall, as it is asking a little too much of the heating ability of many machines to warm up cold eggs and maintain the correct temperature during a cold night. When the eggs are placed in the machine the temperature will fall. After a time the regulator may be lifting and the correct temperature not showing; this is due to the thermometer being nearer the eggs than the capsule which is affected by the coolness of such to a greater degree. The regulation should not be interfered with, as when the eggs are thoroughly warmed, if adjustments have been made carefully in the first instance, the damper will only lift in the event of excessive heat. Once having adjusted the mechanical regulation, any further regulation should be made by the flame, as regulators have their limits and it is unwise to place undue strain upon them.

Thermometers.

All thermometers should be tested prior to the commencement of every hatch, and again at any time that you cannot reconcile the actions of the regulation system with the temperatures. This can be done by placing a clinical and incubator thermometer in a basin of water and gradually increasing the temperature until the clinical thermometer reaches a temperature of 102 deg., and then observe the temperature indicated by the incubator thermometer. If there is any difference, the necessary allowance can be made. If it is expected that there is any serious fault in the incubator thermometer, and no clinical thermometer is available for testing purposes, the bulb can be placed under the tongue. It should read then 98 deg. This method is not as accurate as that described, but it will indicate serious trouble. Incorrect thermometers have been responsible for many poor hatches, and even new purchases may not prove correct.

Temperature.

Temperatures at which incubators are to be operated vary with the position in which the thermometer is situated in the machine. The heat of table-top incubators comes from the top of the machine, consequently the higher in the machine the bulb of the thermometer the greater the temperature shown. The correct temperature when the middle of the bulb of the thermometer is on a level with the top of the eggs is 102 deg. A thermometer hung with the bulb free of the eggs should read about 103 deg.

The heat within the machine is controllable by capsules or thermostat. Occasionally these get out of order by the former leaking or by the latter becoming bent. Very little can be done for a bent thermostat, but capsules may be repaired. The capsule system of regulation is that most commonly used. The capsule is a thin metal container filled with alcohol and ether. This capsule expands with

heat bringing into play the regulating device, allowing surplus heat to escape from the egg chamber, or preventing the intake of heated air. If the capsule is thought to be faulty and difficulty is encountered in regulating the machine, it can be tested by placing it into warm water for a few seconds. If expansion takes place it will prove that the capsule retains some of the liquid, and if no escape of gas can be detected by smell it is reasonable to assume that it is in good order.

During the course of the hatch the temperature will increase slightly, and just prior to hatching may go as high as 104 deg. This extra temperature is due to the increase in animal heat of the developing embryo, and need cause no worry unless it is excessive.

Turning.

Begin turning the eggs at or about forty-eight hours after setting and continue to do so twice daily until the nineteenth day. Occasionally, if the temperature has been a little too high, the eggs will pip on the eighteenth day. When this is the case, turning should cease as the chicken has put itself in a position to release itself from the shell.

When the eggs are placed upon the egg tray, set them at an angle of about 45 deg. with the large end up. To turn these it is necessary to handle every individual egg unless patent turning devices are used. This may be done by simply pulling the egg over upon its small end to the other side. After testing, turning may be done by gently moving the eggs over with the palm of the hand. Complete turning is not essential. All that is necessary is a movement sufficient to make the embryo seek another position in order to prevent sticking to the shell lining.

Cooling.

Cooling is a method of giving the eggs a thorough airing with the consequent strengthening of the embryo. The necessity of airing varies with the make of machine on account of the variation in the supply of fresh air. It is, however, important to remember that for the first seven days very little airing is required, and that the young embryo is very subject to chill. The time it takes to turn the eggs is sufficient. After the first week the eggs may be kept out of the machine until they have lost that burning heat. The period necessary will vary with the stage of development and the outside temperature. A good plan is not to cool the eggs to that degree that the correct temperature in the machine cannot be regained within an hour. In airing, place the eggs upon a table. Do not allow any portion of the tray to overhang, otherwise some of the eggs may become chilled owing to the greater circulation of air. Airing should be practised up until the nineteenth day, but if the eggs are then chipping they should not be aired.

Testing.

This should be done upon the seventh day. It may be done earlier, but the time necessary to do so may result in chilling; furthermore, the germ at an earlier age is not pronounced, and in brown-shelled eggs it is almost an impossibility to discern it unless a powerful light is available. All infertile eggs and dead germs should be removed. This practice gives more room in the tray, facilitates turning, and avoids live eggs being affected with the colder infertile egg. To test, a piece of cardboard having a hole in it similar in shape to that of an egg but

slightly smaller and a lamp are necessary. The cardboard is held up to the light and the egg placed against the hole in it. An infertile egg will be perfectly clear, a fertile egg will have a dark movable spot, about the size of the head of a match, with numerous blood vessels radiating from it, while a dead germ will show as a blood ring or streak, and generally stationary.

Ventilation and Moisture.

These are both interlocked. If a machine has a rapid circulation of air through it, it will require more moisture than a machine in which the circulation of air is slow. The reason why moisture is supplied is to prevent a too-rapid evaporation of the moisture content of the egg. Undue evaporation of the egg content is detrimental to good hatches and to the correct development of the embryo. Enlargement of the air cell naturally takes place due to the evaporation of the moisture content and the escape of carbon dioxide through the shell. This enlargement can easily be judged when testing, and if too great restrict the air circulation or increase the moisture content of the air passing through the machine. The reverse would be necessary if insufficient enlargement was not taking place. Many machines are supplied with moisture trays. These should be filled at the commencement of the hatch and kept filled throughout. When moisture trays are not supplied the air, which passes through the machine, carries sufficient moisture at times. If it is necessary to increase the moisture content of the air taken in by the machine the floor of the incubator room can be moistened; this may have to be done daily in some climates.

Good ventilation is equally essential for the growth of the chicken within the egg as it is for the development of the chick when hatched. Without oxygen the changing of the egg content into a lusty chicken is impossible. If a fertile egg is examined upon the seventh day a network of blood vessels can be seen near the shell. The blood stream not only converts the food into the embryo but it carries off the waste product (carbon dioxide), and without a good circulation of air this poisonous gas is not removed sufficiently fast, and consequently has a weakening effect on the developing chicken. It will be understood that the more advanced the embryo is the greater is the need for oxygen and greater will be the amount of carbon dioxide given off; therefore, what will be the correct ventilation for the first few days will not suffice when the eggs are in the third week of development. The increasing of the ventilation at this period will also assist in the regulation of the temperature of the incubator. Again, when the chickens hatch, ventilation should be increased, and if the chickens are noticed panting the door of the machine should be left slightly open.

The Hatch.

After the last turning, on the nineteenth day, close the incubator and do not interfere with it until the hatch is over unless something unforeseen occurs. When the chicks have dried off give all the ventilation possible, darken the doors to prevent picking at the droppings or the toes of one another. It is as well to let them remain under these conditions for twenty-four hours, after which they may be removed to the brooder.

Disinfection.

Immediately the chickens have been removed from the machine it should be thoroughly cleaned and disinfected. A good disinfectant is

formalin. Any other good coal tar disinfectant may be used. The machine should then be closed up, and when dry opened and thoroughly aired before being used again.

Brooding.

Artificial brooding of chickens is a difficult process with an inefficient plant. The object of the breeder is to keep the chickens warm and comfortable and to wean them from heat as quickly as possible.

A good illustration of the requirements of brooding is given by the hen. She regulates the heat to the chicks under her care according to the age of the chick and weather conditions. If the chickens are young she moves about very little and sits fairly close and gradually increases her ranging habit as the chicks develop. Upon a cold wet day it will be noticed that she collects her brood frequently and warms them up.

In artificial brooding similar principles have to be followed with this difference—that the chickens have to be trained to do for themselves what the broody hen encourages.

Systems of Brooding.

Two systems of brooding are in common use in the State—namely, what is known as cold brooders and heated brooders. In both systems many types of brooders are used.

Cold Brooders.

The term cold brooding is a misnomer. Artificial heat is not supplied, but the heat of the body of the chicken is retained by means of cloths or flannel and a restricted circulation of air. This system of brooding has been practised for many years, but it is only in comparatively recent years that it has been used to any great extent by commercial poultry farmers. The illustration of the cold brooder will convey the nature of their construction. The cold brooder can be operated in brooder houses or rearing pens with an equal degree of success. Although the writer has operated the cold brooder with apparently equal results to the heated brooder, the latter is favoured. It can well be understood that the placing of chickens that have travelled a day or so under a cold brooder, which has to be warmed up with their own bodily heat will not be attended with as good results as would be the case if they were put under a heated brooder. Also, that in cold, bleak weather the heated brooder would offer greater advantages than the cold.

Heated Brooders.

There are many types of heated brooders, but they can be referred to as the box, the colony, and the battery. The former system is not used to any extent in this State. This, in the first instance, may be due to the cost of installation of a suitable type, and secondly to the general satisfactory results from the colony system.

Colony Brooder.

Where large numbers of chickens are to be reared the colony brooder appears to be the most economic, with the exception of possibly the newer system known as the battery, and as effective as any other type. With this class of brooder several hundreds of chickens can be run together with little more trouble and attention than would be

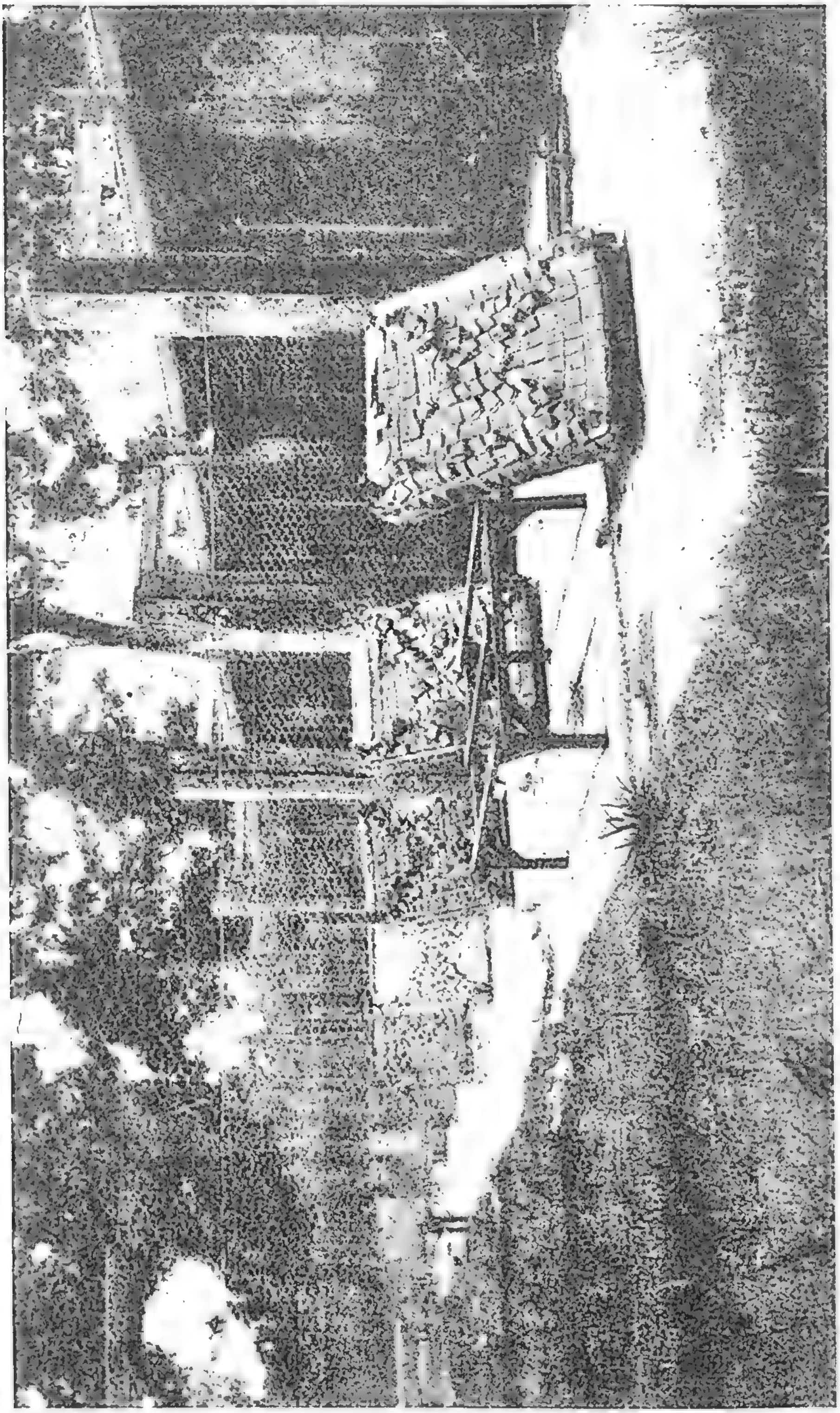


PLATE 151.—COLD BROODERS.

Showing numerous Cold Brooders being operated in a continuous house. Brooders taken from the house daily and placed in sun to air.

required for a lot of 100 under any ordinary brooding system. This system also permits of a very much freer movement of chickens once they have been educated as to the source of heat, and assists in the retention of that keenness in life that is essential to health and growth.

Five hundred chickens should, however, be the limit in any one colony brooder, but possibly 100 less would give better results. It is also generally a sound rule to depreciate the capacity claimed for brooders by most manufacturers.

The colony brooder consists of a heater with a metal hover for the purpose of deflecting the heat. The fuel used may be coke, sawdust, kerosene, or electricity. Whatever type of colony brooder is to be used should be housed in a special brooder house. It is possible to operate them in open-fronted houses by cutting off ground draughts, but it will be readily understood that when such is the case considerably more fuel is used. In the case of kerosene and electric-heated brooders the increase in the costs of heating in open-fronted houses would be considerable. With the sawdust and coke brooders costs are not excessive, but the great disadvantage with operating in open-fronted houses is to keep the heat at a uniform temperature. It is found in practice that they will burn out within a period of twelve hours and in some cases less with the consequent chilling of the chickens.

A suitable sized building to house a 500 colony brooder would be one that measured approximately 14 ft. by 16 ft. and at least 6 ft. high. The roof may be either a hiproof or skillion, the building lined and ceiled and provided with ample light. It should be built to face north-east or north and arranged so that the sunlight can be freely admitted. Lighting through glass is desirable in bad weather, but direct sunlight is essential to admit of the ultra violet rays. Failing this cod liver oil is an essential to all chicken-mashes, in order to supply Vitamin D. A few weeks of brooding without sunlight or cod liver oil would soon result in leg-weak chickens. Sunlight is the cheaper.

The house may be built of timber or iron. Iron is to be preferred, being of a more lasting nature and offering less harbour for vermin. The lining and ceiling should, for preference, be of $\frac{5}{8}$-inch, tongued and grooved pine, but for economy wheat sacks sewn together and whitewashed will serve. The floor should be concreted to facilitate cleaning, and a thin concrete wall sunk into the ground to a depth of 18 inches. This wall prevent rats burrowing under the floor.

Battery Brooding.

This system of brooding is comparatively new to Queensland. It consists in the brooding of chickens under very intensive conditions with the practice of the maximum sanitation. The chickens are never allowed to run upon the ground. Day and night they are kept upon small mesh wire. This permits of the droppings immediately they are voided falling upon a tray situated so that is may be conveniently cleaned. Food and water are placed outside the brooder and the chickens fed through bars or netting according to the construction of the brooder. The food and water being in such a position that they cannot be fouled, and as the droppings are never upon the floor of the brooder, it is almost impossible for chickens to obtain disease producing organisms from other chickens.

PLATE 152.—A KEROSENE-HEATED COLONY BROODER.
Showing curtain of hessian and wire for restriction of range.

The illustration is that of a home-made brooder which measures 3 feet by 6 feet. In this particular make there are two tiers. The floor is ½-inch netting and the dropping tray galvanised iron. The sides are movable. In the early stages of the chicken's life 1-inch netting is used, and as development takes place 1¼-inch netting. The chickens obtain their feed and water from the troughs by passing their heads through the netting. When the chick is very young the trough is tilted to facilitate feeding, and as development takes place lowered to a level position. This is done by a small wire hook which is attached to the tray.

This class of brooder has to be heated. In this case a small kerosene lamp is set up in half a kerosene tin under sleeping compartment. This tin only reaches to within 1 inch of the netting floor, consequently there is no one part of the floor excessively heated. Retention of heat is obtained by having a hessian curtain in front of the sleeping compartment and a hessian pillow filled with straw on the top. This pillow is kept low during early life and raised as the chickens grow. Naturally, ventilation must not be restricted to too great an extent.

The writer has seen chickens kept in this type of brooder until they were eight to ten weeks of age with no apparent ill effect. They are, however, naturally soft due to lack of exercise, and breeders are well advised to get them out of the brooder much earlier. When they are four to six weeks of age it should be possible to wean them from the heat in a manner similar to that used in other types of brooding.

It has been frequently noticed that chickens removed from battery brooders have been effected shortly after removal with coccidiosis. Mortality due to this disease has appeared to be greater upon the same farm with this class of brooded chicken than with any other. It has been suggested by some authorities that this is due to the heavy infestation with the organism responsible for the disease in stock that have little resisting power. Whatever the cause it demonstrates that, although chickens have been protected from the disease early in life by being battery brooded that they are still subject to an attack.

Temperatures.

In heated brooders temperature is a very important factor. If insufficient heat is supplied the chickens crowd together. The correct heat is the only method by which this can be prevented. Overheating is also to be avoided on account of its weakening effect and the difficulty that will be experienced in weaning from the brooders. The general comfort of the chickens is a sure index that the temperature is fairly satisfactory, and if the droppings are well distributed under and around the hover in the morning, it is proof that the chickens have been fairly comfortable. When the chickens are first put into the brooder they come from a nursery in the incubator which generally has a temperature of at least 90 deg., and it is as well to start your brooders at this temperature, gradually reducing it until heat can be dispensed with in from four to six weeks.

The importance of heat in brooding chickens has been demonstrated by investigators at the Michigan State College. Working with chickens from diseased free stock with a range of temperature from 72 to 96 deg. during the first week of brooding they experienced mortality from 37 per cent. to 5 per cent., and with diseased stock 57 per cent.

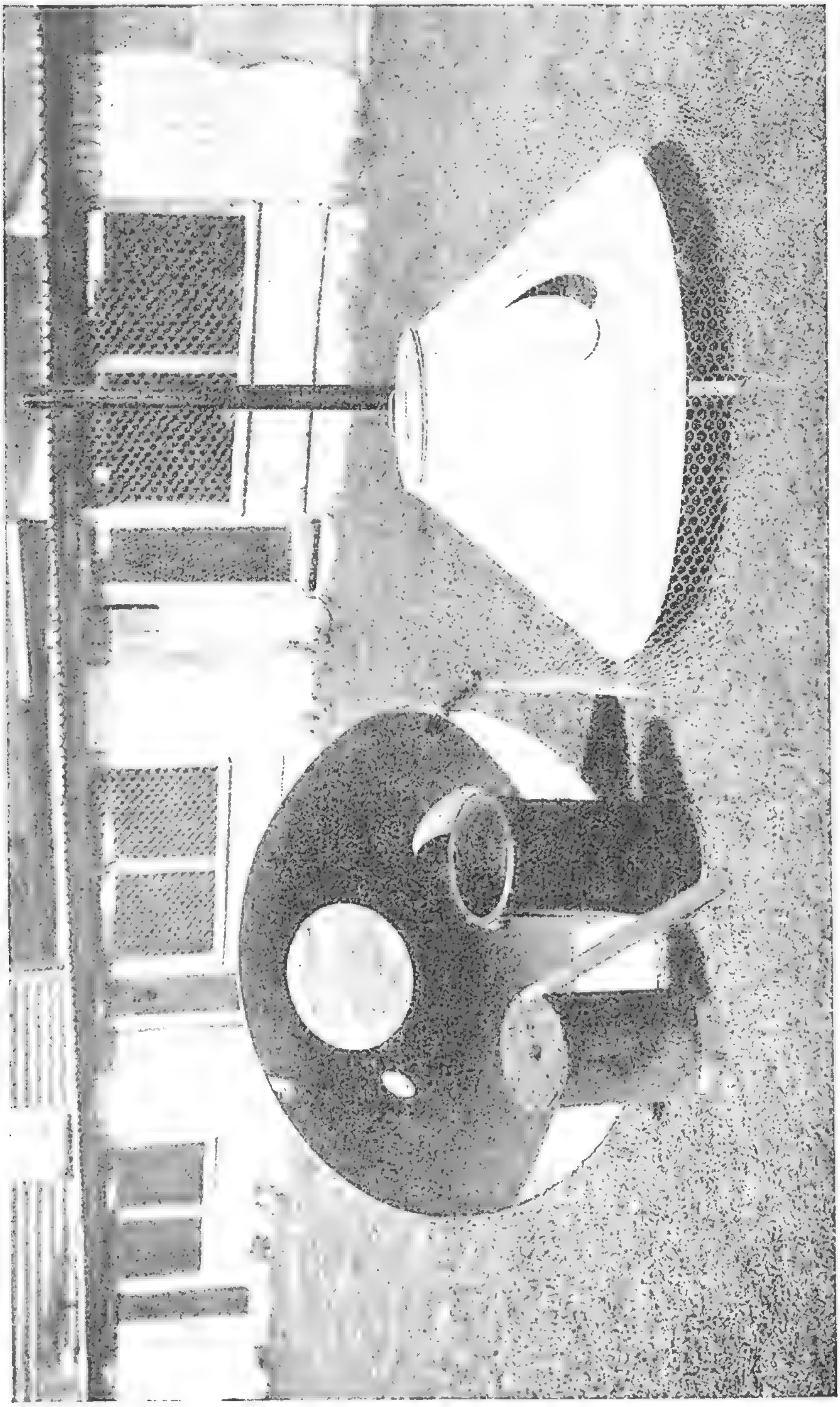


PLATE 153.—A SAWDUST-HEATED COLONY BROODER.

Showing fire bucket filled with sawdust which is fitted into the cylinder on right. Note core in centre of bucket for draught.

to 32 per cent. These experiments were conducted over a period of two years and amply illustrate the importance of temperature.

Ventilation.

With some types of brooders many chickens are lost due to lack of ventilation, and to overcrowding. Brooders which are usually made to hold a 100 day-old chickens are generally too small for the same number of chickens a week old. It frequently happens also that the attendant makes no allowance for additional ventilation with the growth of the chickens, and although he has been successful in rearing them to the age of one week they then start crowding and dying. The lack of ventilation has a great weakening effect on both young and old stock.

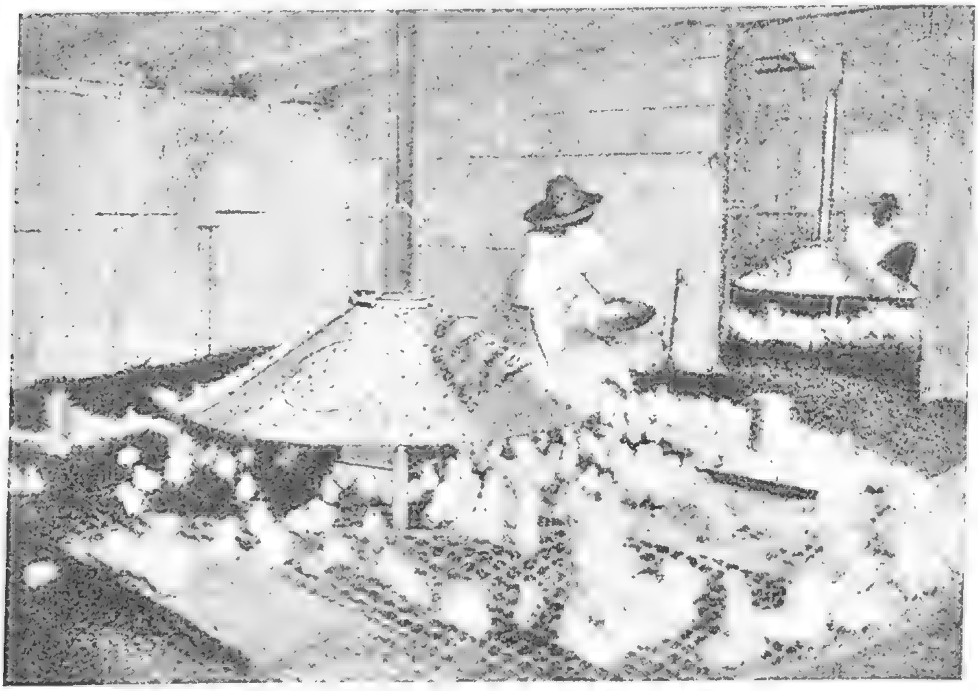


PLATE 154.—A COKE-HEATED COLONY BROODER IN USE.

It causes the young to crowd, and renders the older birds more susceptible to disease. When chickens have crowded they present a wet appearance in the morning, to which the term of "sweating" is applied. Sweating is not the cause. The wetness is caused by the condensation of the moisture content of the breath which would have been carried away if proper ventilation had been provided. Chickens which have been overcrowded rarely recover from the ill-effects, and it should be avoided at all costs.

In brooding under any system the following are essential points:—

(1) Limited range, increasing with age.

(2) Sufficient heat, which should be reduced as early as possible.

(3) Ventilation, which should increase with age.

(4) Correct accommodation. What is just enough room for 100 day-old chickens rapidly becomes too little as they grow.

(5) Never attempt to brood chickens of mixed ages.

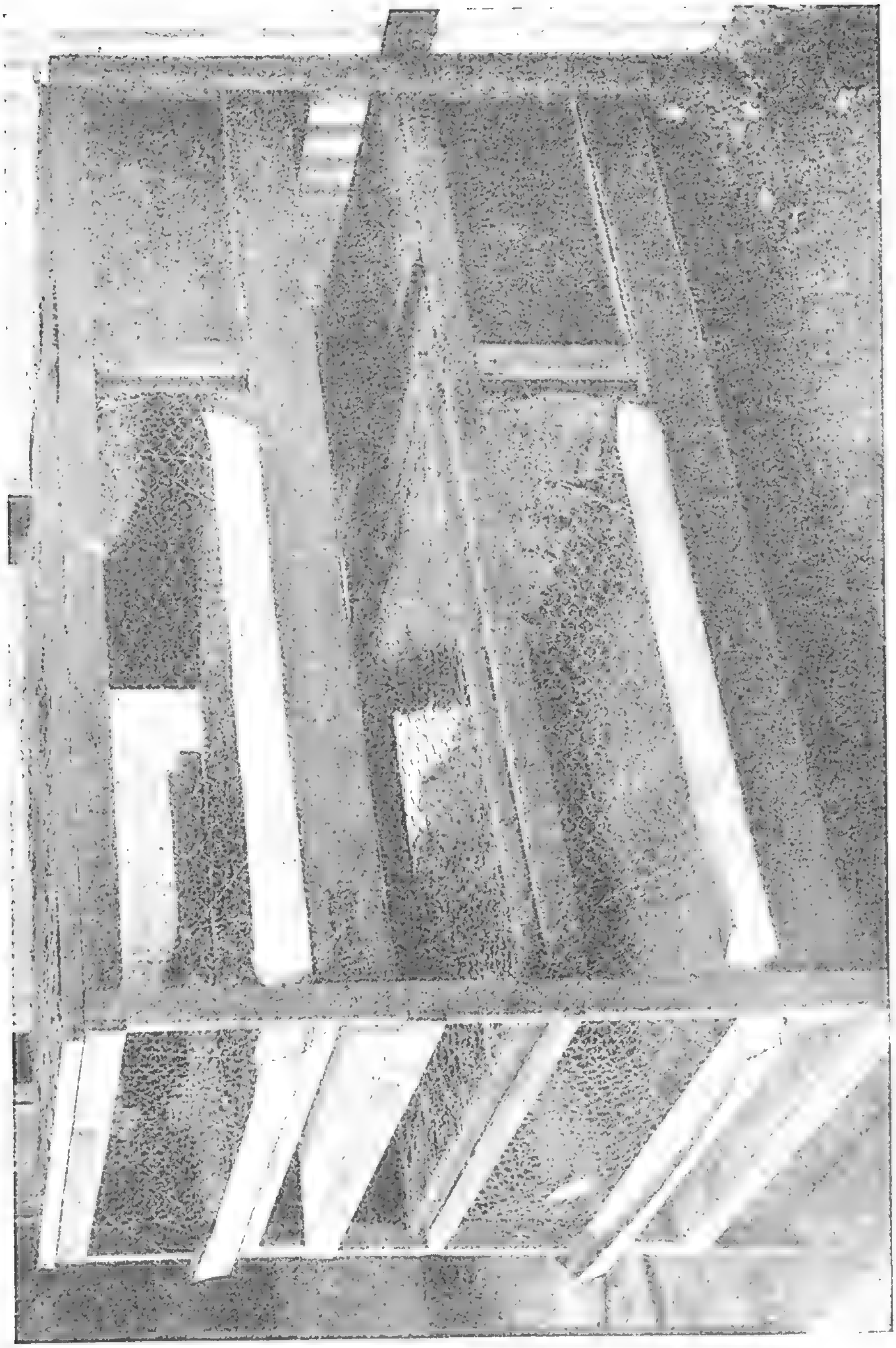


PLATE 155.—HOME MADE BATTERY BROODER.
Showing Simplicity of Construction.

Placing Chickens in Brooders.

When chickens are placed in brooders the floors should have a light dressing of sand or soil to absorb any excreta and to give the chickens a good footing. A small amount of litter in the nature of soft straw or chips will provide exercise and tend to keep the chickens active and prevent vice.

With both hot and cold brooders their liberty should be restrained for a start. This can be done by erecting a barrier of wire netting around the brooder increasing the area day by day. At the end of about one week they can be given the liberty of the brooder house. With the cold brooder the netting should only allow a range of two or three inches for the first day. With the colony brooder the range will depend upon the heat given off by the brooder.

What is necessary is to educate the chickens as to the source of heat, and when this is done to encourage them to take as much exercise as possible by ranging over the entire brooder house.

Most breeders have outside runs to their brooder houses, and the chickens are allowed out in them after they are about a week old. Outside runs are not essential if the brooder house is constructed to permit of abundance of light and sunshine. However, when runs are provided the chickens should be driven in after they have been out for an hour or so upon the first occasion. They may be allowed out again in the course of an hour or so. This should be repeated in order that the chickens will learn to return to the brooder house and avoid to a large extent the possibility of their being caught out in a rainstorm or staying out too long and becoming chilled.

Sanitation.

Cleanliness in every operation is essential; unsanitary conditions not only pollute the atmosphere of the brooders but are frequently the cause of the rapid spread of serious diseases in baby chickens. In very young chickens bacillary white diarrhœa is responsible at times for heavy mortality. The chickens are very subject to this disease within the first ten days. The organism responsible is voided in the excreta, consequently it will readily be understood that a few diseased chickens could be responsible for the spread of the disease among the whole brood. This fact emphasises the advisability of the destruction of apparently sick chickens and the regular and frequent cleaning of brooders.

Coccidiosis, another disease to which chickens are subject, is spread per medium of the droppings. With the former disease some disease effected chickens are the result of effected parents and when hatched are already diseased. With coccidiosis the chicken contracts the disease after hatching. Many adult birds are affected with coccidiosis. The organism is, therefore, easily carried upon the feet of the person attending them to the brooders. Strict sanitation and the application of precautionary measures gives reasonable assurance of protection against the disorder. Brooder houses should be cleaned out every second day and the sleeping quarters daily.

Weaning.

When chickens are from four to six weeks old it is generally necessary to remove them from the brooders to make room for others.

This is also necessary to protect the soil from becoming too foul and the chickens too soft by prolonged supply of heat. Correct brooding will materially assist the weaning process as the heat should have been gradually reduced.

The chickens were trained in the early stages of brooding and training is again essential. Poultry are largely creatures of habit and can generally with care be trained to act as required. When once they form a habit—good or bad—it is difficult to alter. A little time spent in seeing that chickens take to their new quarters during the first few nights will amply repay the poultry keeper, and prevent losses that occur when growing chickens crowd into corners, &c.

PLATE 156.
WEANING PLATFORM AS DESCRIBED IN TEXT.

Chickens may be placed in permanent laying quarters or colony houses when they are to be weaned. The permanent house may be an intensive laying shed or a special colony house. The colony house is an ideal system provided they are situated upon clean land, or in other words land not contaminated with the droppings of adult or diseased birds.

Colony houses can be built upon slides or wheels and moved about the fields or made fixtures. Hurdles or netted yards are necessary to confine the chickens to a certain area until they become accustomed to their new quarters. After a week or ten days these hurdles may be removed, and providing the rearing houses are not too close to one another, the chickens belonging to the various lots will not become mixed returning to their own quarters at night.

The number to be put out together, of course, varies with the accommodation available, but larger flocks than 100 are not recommended; 50 would be safer.

A good rearing house for 100 chickens should be at least 10 feet long and 8 feet deep, this, of course, with free range. The house should be 5 feet high at back and 6 feet high in front. Ventilation should be provided by leaving a space between the top of the back wall and

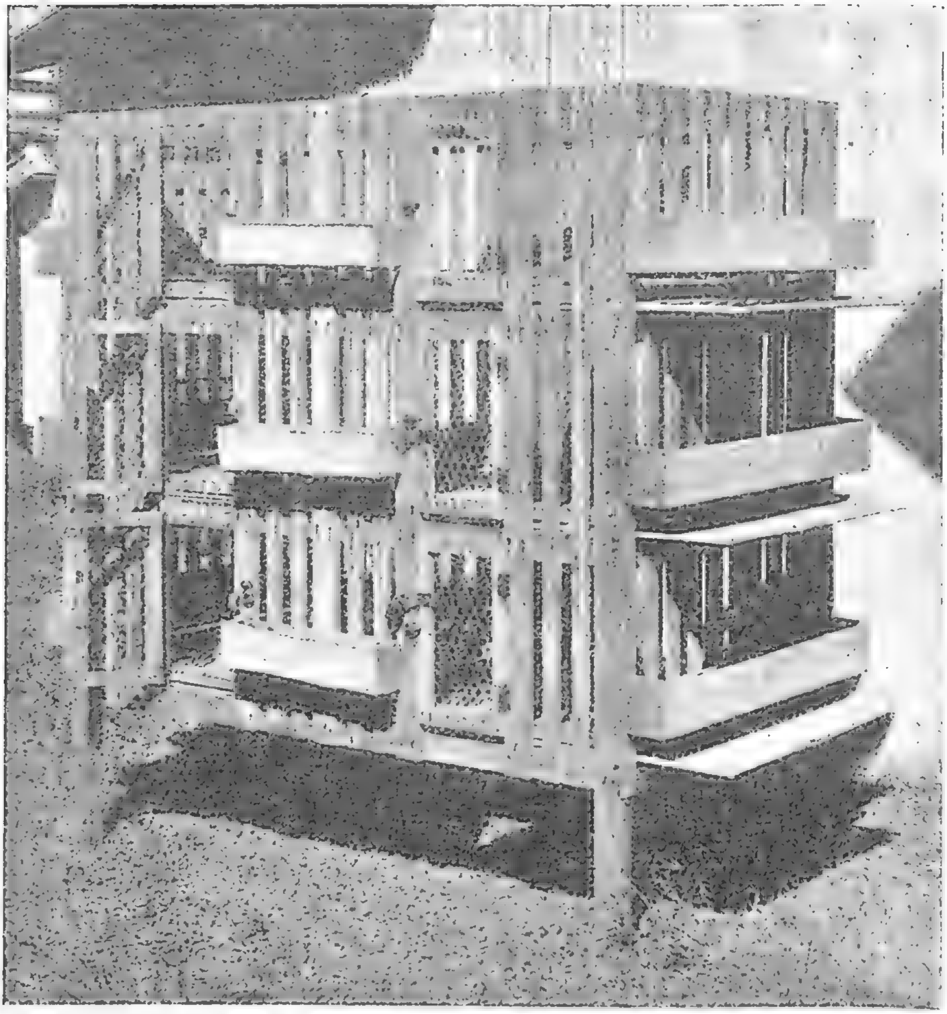


PLATE 157.
BATTERY SUITABLE FOR THE RAISING OF COCKERELS AFTER LEAVING THE BROODER.

roof of 3 inches. As a protection from the south-easterly weather at least 4 feet of the eastern front end should be covered with iron. The front should be netted and provided with a gate in order that the birds can be shut in overnight as a protection from foxes, &c.

General Management.

When the chickens are taken from the brooder quarters and placed in houses to be weaned they are too young to perch of their own free will. Various arrangements have to be made to prevent crowding. Some breeders bed them down on straw. The straw needs to be fairly deep and loose and well heaped up in the corners of the house. The chickens appear to be content to snuggle in the straw instead of making warmth by crowding together. It is then only necessary to go around in the evening with a fork and loosen the straw up. In the shaking the droppings fall on to the floor and are readily cleaned up. With this system of weaning, perches must be erected later and the birds allowed to take to them at will.

Another system of weaning and one that educates the bird to perch at the same time is to erect a wire netting platform about 6 inches from the ground with a netting run up. On the top of this frame several strips of 2 by 1 timber are attached. The chickens at night are not allowed to rest anywhere but upon this platform. They certainly crowd together for a start but soon spread out. The netting allows for a circulation of air and they experience no ill-effects. It is necessary to watch the chickens for the first few nights, but immediately they have settled down they can be left.

In erecting this platform it is essential to make it the full width of the house and at the closed end.

The thinning out of chickens as they develop must be practised. No hard and fast rule can be laid down as to when this thinning out should be practised as the work is dependent upon the space available.

With leghorns, if it is not intended to rear the cockerels for stud or table purposes, many could be disposed of at about three weeks of age. This will reduce costs and give the growing pullets more room. With all breeds it is desirable to separate the sexes as early as possible, and where males are to be grown for market purposes to place them under very intensive systems of housing, and to feed them with the object of obtaining the maximum growth in keeping with costs.

Young stock that do not appear to be thriving should be destroyed whether they be cockerels or pullets, as it is little use trying to make a satisfactory producer or table fowl out of an apparently unfit chicken.

Marketing Oranges at Home and Abroad.

By JAS. H. GREGORY, Instructor in Fruit Packing.

PART I.

MARKETING oranges successfully at payable prices is now, through the tendency towards over-production in Australia, becoming an ever-increasing problem. Growers, in order to get the best prices for their fruit, should spare no effort in trying to attain the perfection of pack and "get-up" which will command top market prices. To do this it is necessary to take the utmost care in harvesting from the trees, and, when in the shed, in sizing and grading for quality; in the selection of the type of case and case timber; and finally in the labelling and stencilling. The fruit should be graded most carefully for quality.

Harvesting.

When the fruit appears to be ready for harvesting and sending to local markets, growers should make a test of a few specimens before finally deciding to pick. The test should show if the fruit will conform to the standards of maturity laid down in the Fruit and Vegetables Act administered by the Department of Agriculture and Stock, Queensland. If exporting overseas it is necessary to conform to the standards set by the Commonwealth Export Regulations, or if sending interstate to conform to the regulations of the State concerned. To make the test, specimens should be selected from trees in different parts of the grove, so that an average sample for the grove is obtained.

When the fruit is found to have matured, growers may go ahead with their harvesting. They should select only the largest sizes, for this allows for the packing of the most popular sizes, as well as ensures the highest standard of maturity. It has been found that large-sized fruit usually tests better for maturity than small-sized fruit. In picking it is usually better to make two clips—one to remove the fruit from the tree and a second to remove, if any, the surplus stalk. Gloves should be worn while handling the fruit to avoid finger-nail damage.

The best type of clipper is the blunt, parrot-nosed type. Picking bags, which are not recommended, if used, should be used with great care, as they are often a source of great damage to fruit when carelessly handled, causing stalk rubs, which add to the chance of mould infection. It will be found that baskets, or kerosene tins cut lengthwise and provided with handles or straps to place around the shoulders, are most satisfactory for harvesting. Fruit should never be tipped or rolled into the harvesting boxes. Care should be taken to see that in the cases or picking containers there are no projecting nails or pieces of wood that could cause damage to the fruit.

Whilst picking, a preliminary sorting or grading for quality should be made. This can be done by having the picking cases at central points in the orchard and grading the fruit into boxes as it is handled from the picking tins to the cases. Three grades should be made—i.e., "Special," "Standard," and "Factory."

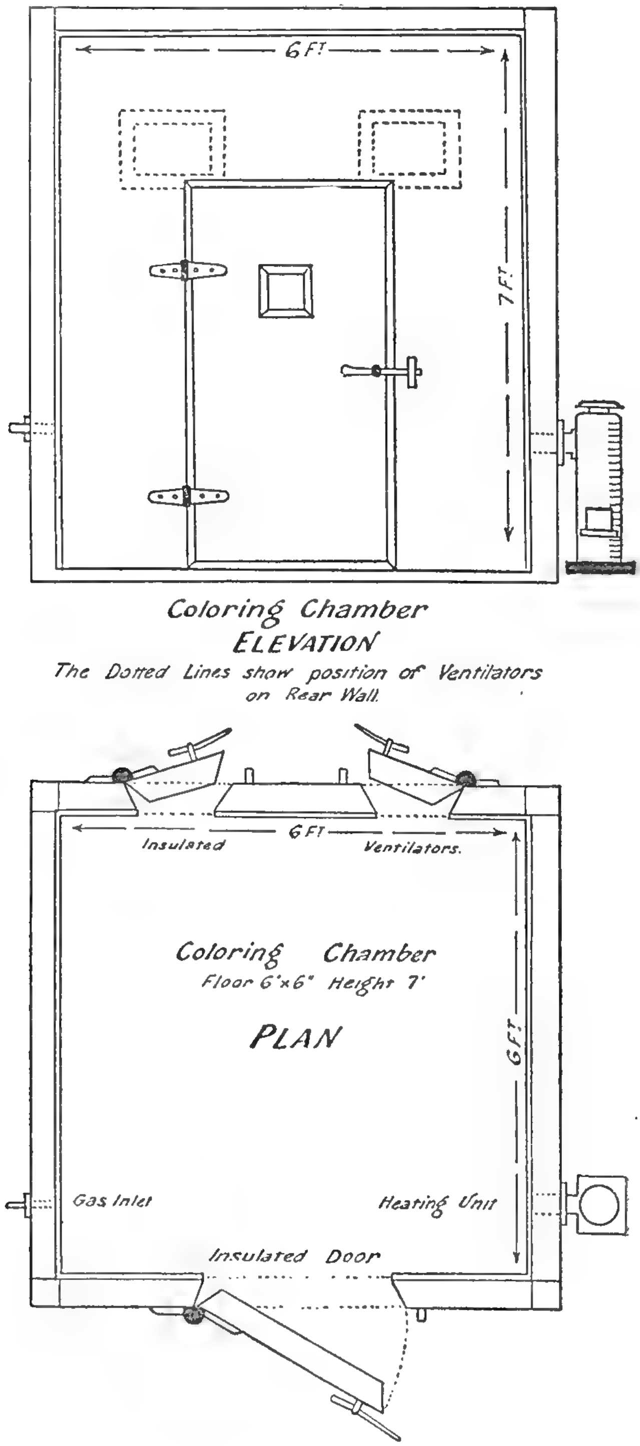


Plate 158.

Plan and Elevation for Colouring Chamber.

Note.—The placing of the door with its inspection window and ventilators, which should be made as gas-tight as possible. Provision is also made for artificial heat and the application of the gas.

Colouring.

The appearance and value of fruit is enhanced by colouring. Only matured fruit will respond satisfactorily to the process of artificial colouring, immature fruit will not attain the rich colour so admired on the market. The Ethylene gas process has been found to give great satisfaction. Acetylene gas has also been used with success. It is necessary with both of these processes to have a gas-tight chamber to hold the fruit in whilst applying the gas.

Ethylene Gas Process.—Ethylene gas is procured in cylinders. The temperature for oranges during the colouring process is best kept at about 75 deg. Fahr.; this is different from lemons, which should be kept at 65 deg. The fruit is placed in a gas-tight chamber and the gas is injected, the quantity being one cubic foot of gas to each 1,000 cubic feet of space in the room. A gauge is attached to the cylinder for measuring the amount of gas for each application.

The best method of placing the fruit in the chambers is by using flat trays containing a single or double layer of fruit which will allow of free access of gas to the fruit. If these prove too expensive, growers can use cases which should be made on the flat and have the boards well spaced apart. The bottom layer of trays or cases should be placed on battens spaced on the floor of the chamber. It is recommended that the same cases be always used for the colouring process, as they can then be kept clean and free from fungus infection. Spraying the chamber and cases occasionally with a 1 in 20 solution of formalin will assist in eliminating infection from moulds. In applying the gas nothing is gained by using a larger quantity than is necessary. After the correct quantity of gas has been applied at the correct temperature, shut off the gas and allow the room to remain closed for at least four hours. The chamber should then be opened and the fruit completely ventilated to renew the oxygen. This needs to be done as quickly and completely as possible in order to keep the temperature of the fruit from changing in any marked degree. It is of advantage to allow the fruit to stand without gas for one or two hours before recharging the chamber. Two applications per day are sufficient. The same method of application is sufficient, nothing being gained by recharging sooner than four hours after the previous application of gas. Oranges properly coloured by this process have a greatly enhanced appearance. If oil sprays have been used on the trees it is advisable to use care in colouring, as the skin of the fruit is inclined to burn through chemical reaction.

Acetylene Gas Process.—The same type of gas chamber as used with Ethylene gas is necessary. The method of application is similar in most respects to the use of Ethylene. The correct quantity of carbide to use is determined by the size of the chamber. One ounce of carbide generates sufficient gas for 75 cubic feet of air. Experiments conducted by departmental officers in Queensland give the following table for general use:—

Size of Chamber.	Number of Bushel Cases.	Air Space When Stacked.	Dosage.
Cubic Feet.		Cubic Feet.	Oz. Carbide.
200	40	150	2
200	20	175	2⅓
200	10	187½	2½

A suitable container which permits the water to drip slowly on to the carbide should be used.

Nine to fifteen charges should give oranges a normal colour.

When using the Ethylene or Acetylene gas treatment with oranges the following points should be closely observed:—

Keep a temperature of approximately 75 deg. in the chamber.

Have fruit packed loosely in boxes or trays so that the gas has a free circulation around the fruit.

Stack the bottom layer on battens spaced along the floor of the chamber to permit a free passage of gas beneath the fruit.

Apply the correct quantity of gas according to the size of the room.

Allow the room to remain closed for at least four hours.

Open and ventilate the fruit as quickly as possible to renew oxygen.

Repeat the same process for further applications.

Remember that nothing is gained by overcharging or charging the chamber too often, so do not increase the cost by wasting gas in this way.

Care should be taken to keep all naked lights away from the room or gas cylinders when using the gas, as the mixture becomes dangerous when a large quantity of gas is mixed with air.

The following points must be strictly adhered to if the colouring process is to be of advantage to the industry.

Do not attempt to colour immature fruit, as it will not attain to a satisfactory product, being of a light and often dull colour which will not attract buyers.

Only perfectly dry fruit should be treated. Wet or damp fruit will scald severely and break down during transit to market.

Care must be taken that no oil or Bordeaux sprays remain on the fruit during treatment. Fruit not free of these sprays will become blotchy and unsightly during treatment.

Bruised areas on oranges will not colour properly.

All damaged fruit should be eliminated before colouring.

Remember artificial colouring will not increase the sugar content of oranges.

Building the Gas Chamber.

The building may be constructed of suitable timber, insulated and lined, or built of iron (which latter is hard, however, to make gas-tight). The process is done quicker and more efficiently with less waste if the chamber is made gas-tight. To make a gas-tight chamber, which means a large saving in the quantity of gas used, the space between the outside wall and lining boards should be insulated by filling with saw-dust, wood-shavings, charcoal, or other suitable material. This is also a big factor

in maintaining an even temperature. Paper-lining in addition to the filling is an additional improvement. In filling the cavity between the outside wall and the lining boards, trouble can be avoided by building the wall and lining at the same time and placing the filling in position as the wall is erected. As a sufficient supply of oxygen must be maintained in the room, it is necessary to change the air after every application of gas. To do this successfully ventilators should be placed at the opposite end of the room to the door. The door and ventilators (*see* Fig. 1), should be made as close-fitting as possible, and insulated in the same manner as the walls to obtain best results. By placing the ventilators at the opposite end to the door the air can be quickly changed in the room by opening both at the same time without causing any undue variation in temperature.

Temperature Control.

Heating to obtain the correct maximum temperature of 75 deg. Fahr. may be necessary in some climates, so provision should be made when building the gas chamber for the erection, where necessary, of a heating system. By building the room in a corner of the packing shed a more even temperature may be maintained, and in many parts of Queensland should make it unnecessary to install heating apparatus.

It should be remembered that, during warm periods, to help keep the temperature low, it is necessary to allow the fruit to cool before placing it in the chamber. A chamber 6 feet by 6 feet by 7 feet will hold fifty cases stacked loosely. Changeable climatic conditions will affect the humidity of the inside of the chamber. If the oranges show signs of withering during the colouring process, it will help to stop this withering if the humidity is increased by placing a dish of water or wet bags in the chamber. To avoid opening the chamber unnecessarily the thermometer should be placed in the chamber where it can be seen without opening the door. A small window built in the door will allow of easy observation of the thermometer and interior of the chamber.

Packing for Market.

Types of Cases.—Both the Australian Dump Case, internal dimensions 18 inches long by 8¾ inches wide by 14¼ inches deep, and the Canadian Standard Case, internal dimensions 18 inches long by 11½ inches wide by 10½ inches deep, are excellent containers. Both of these cases lend themselves admirably to the count system of packing. Such cases as the Long Bushel and other types of cases have not the same satisfactory features. Cases of the Long Bushel type do not permit of easy packing, being too narrow, causing skin damage to the fruit through rubbing on the side of the case whilst being placed in the bottom layers. The quantity of fruit touching the wood is also a source of increased damage through pressure and vibration whilst in transit. These cases, being narrow, do not lend themselves to standard-count packing, variation in the type of pack having to be used, making it practically impossible to have a definite system of standard counts for buyers. Most packs in cases of this description give the impression that the cases are only half-filled owing to the large number of packs with large spaces showing between the fruit. Buyers, seeing this and not knowing the number of fruit in the case, inevitably cut the price to safeguard themselves. Growers should insist on cases cut to the correct size and are well advised not to make up cases if the boards, when nailed

to the ends, have spaces between them of more than one-quarter of an inch. Spaces wider than this are often the cause of cutting the fruit on the side of the cases whilst in transit. It pays to use only a first grade milled case.

During visits to orchards many growers are found who do not make their cases correctly, thereby making it harder to do the standard packs required on the market. Another grave fault found is the bad milling of some of the boxes, causing the sacrifice of the essential features which make a particular type of box a success. A particular instance of this is the Standard box used for citrus fruits and apples. We often find that millers cut thick tops and bottoms for this box thereby precluding any chance of the packer putting a correct bulge in the case without damage to the fruit. The correct internal dimensions of each case will be given, together with a few remarks on the various features in the making up. I will not give the length and breadth of boards as these vary with the thickness of the ends of the case and the particular type of timber the case is milled from.

Australian Dump Case.

(18 inches long by 8⅜ inches wide by 14¼ inches deep.)

Thickness of ends—Minimum, ¾ inch.

Thickness of sides—Minimum, 5-16 inch.

Thickness of lid and bottom: ¼ inch exact.

Use 1¼ inch nails for sides, 1½ inch for tops and bottoms.

Canadian Standard Case.

(18 inches long by 11½ inches wide by 10½ inches deep.)

Thickness of ends—Minimum, ¾ inch.

Thickness of sides—Minimum, 5-16 inch.

Thickness of tops and bottoms—Maximum, 3-16 inch.

Dimensions of cleats: 11½ inches long by ¾ inch wide by 3-16 inch minimum thickness.

This case is made up with thin tops and bottoms to permit of a bulge of 1 inch to 1½ inches in height to be placed on the top and bottom of the case; the thin timber permits this bulge without damage to the fruit. The cleats are used to be placed across the ends of the lids and bottoms (see Plate 159) to strengthen the thin boards and assist in the prevention of splitting. The thick sides are necessary as all cases are stacked on their sides when in transit.

Use 1¼-inch nails for sides and 1½-inch nails for tops and bottoms.

The cleats (A.) are placed across the ends of the pieces of timber used for the tops and bottoms of the case and are not used in the position indicated by the dotted lines (B. and C.). If growers are supplied with a case with two-piece ends it is suggested that corrugated fasteners (D. and E.) be used instead of the cleats (B.) indicated. Two fasteners (D.) to join the two pieces should be placed on one side of the end about 1 inch from either edge, and one fastener (E) in the middle on the opposite side of the end.

Californian Citrus Box.

(24 inches long by 11½ inches wide by 11½ inches deep with partition.)

Ends and partition—Minimum thickness, ¾ inch.

Sides and bottoms—Minimum thickness, 5-16 inch.

Top—¼ inch thick with cleats attached as on the Standard box.

Cleats—11½ inches long by ¾ inch wide by 3-16 inch, minimum thickness.

Use 1½-inch nails for making and nailing.

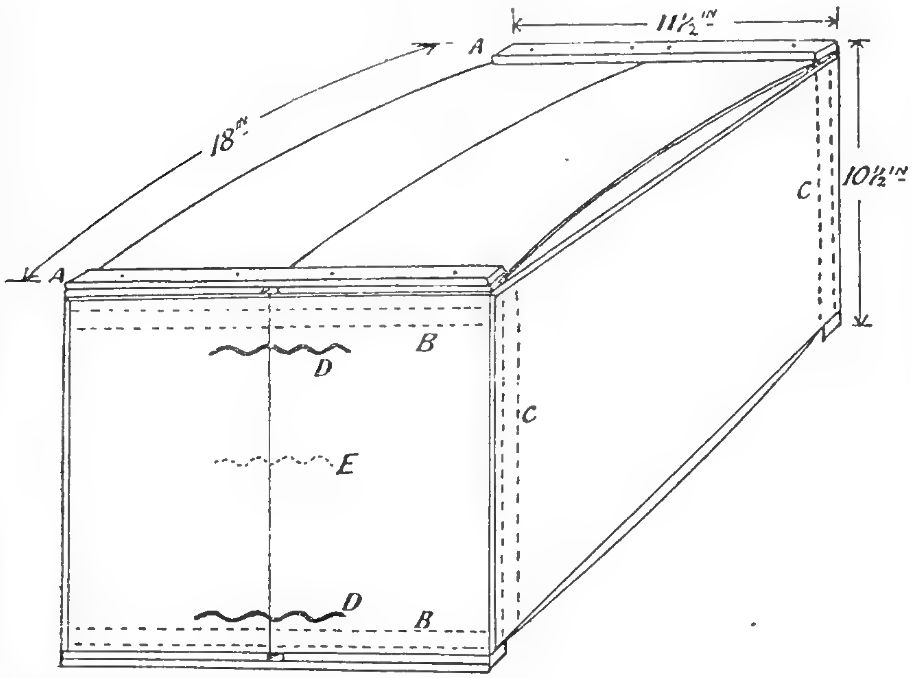


PLATE 159.
Sketch of Canadian Standard Case.

Grading.

As previously mentioned, three grades are recommended:—

"Special," consisting of sound, mature, unblemished fruit of even colour;

"Standard," consisting of sound, matured fruit not unduly marked by insects, fungus, or other injury, and matured fruit unblemished but of poor colour;

"Factory," consisting of blemished fruit free from disease or insect pests.

The operation of grading should be carried out during the whole period of handling the fruit. Whilst picking and when placing from the picking container into the orchard cases, the harvester should separate the "Special" from the "Standard" and "Factory" grades. By doing this "Special" and "Standard" are contained in separate boxes ready for the colouring process. After colouring and whilst transferring the coloured "Special" grade fruit on to the sizing machine a further sorting should be made, any poorly-coloured fruit or

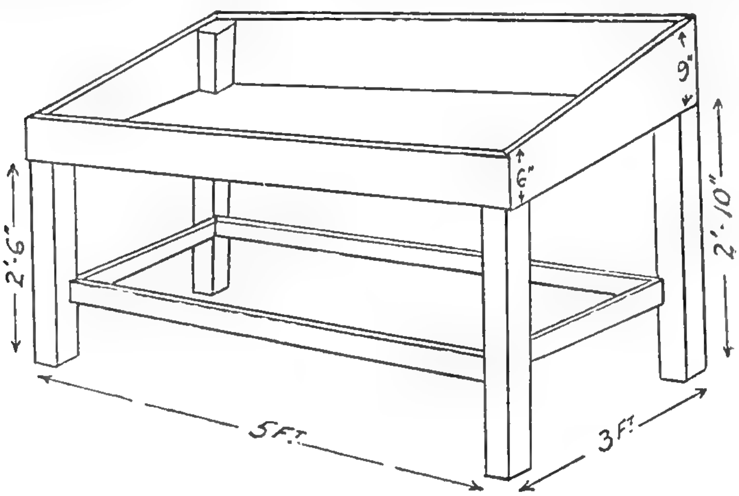
blemished specimens that may have been missed during the first sorting being removed and placed with the "Standard" grade. The same process can be used at this stage to separate "Standard" and "Factory" fruit.

Wrapping.

It is recommended that first grade oranges be wrapped. Wrapping is of great assistance in the safe carriage of oranges over long distances, thereby appealing to the country-order buyer. The wrapping of oranges isolates each individual fruit from the possibility of mould infection from its neighbour, so that in the event of one fruit becoming affected the wrapping paper is a means of preventing infection to the fruit next to it. When wrapping oranges the fruit should be placed in the wrapping-paper and the ends of the paper folded under and on to the cheek of the fruit, forming a pad on which the fruit is placed, and giving a very finished and neat appearance to the wrapped and packed layer.

Sizing.

Sizing the fruit before packing assists greatly in making packs easy to do and easy to bring to the correct height in the case, although there are packers who find no difficulty in packing unsized fruit by using a roomy bench (*see* Plate 160) to hold the fruit, tipping one case only



Fruit Bench to assist in Grading.

PLATE 160.

Fruit Bench to Hold Fruit whilst Packing.

Where there is no mechanical sizer this type of bench is very useful. Greatest efficiency is obtained when only one case at a time is tipped for packing. Please note that the bench is higher at the back than at the front, allowing the fruit to always be close at the packer's hand.

on the bench at a time. The packer then packs two different sizes at the same time, and, while packing, sorts the remaining sizes into separate heaps on the bench. Growers who are fortunate enough to have a mechanical sizer will find the operation of packing made easy provided that care is taken to avoid the pitfalls associated with mechanical sizers. Firstly, it should be remembered that in practically all mechanical sizing

machines two different counts of fruit can be packed from each bin, packing being made very easy if this rule is followed. To enable this to be done it is well to have packing stands of the type illustrated (*see* Plate 161). A spring board of the type illustrated is also helpful in preventing packers from getting aching backs, tired feet, &c.

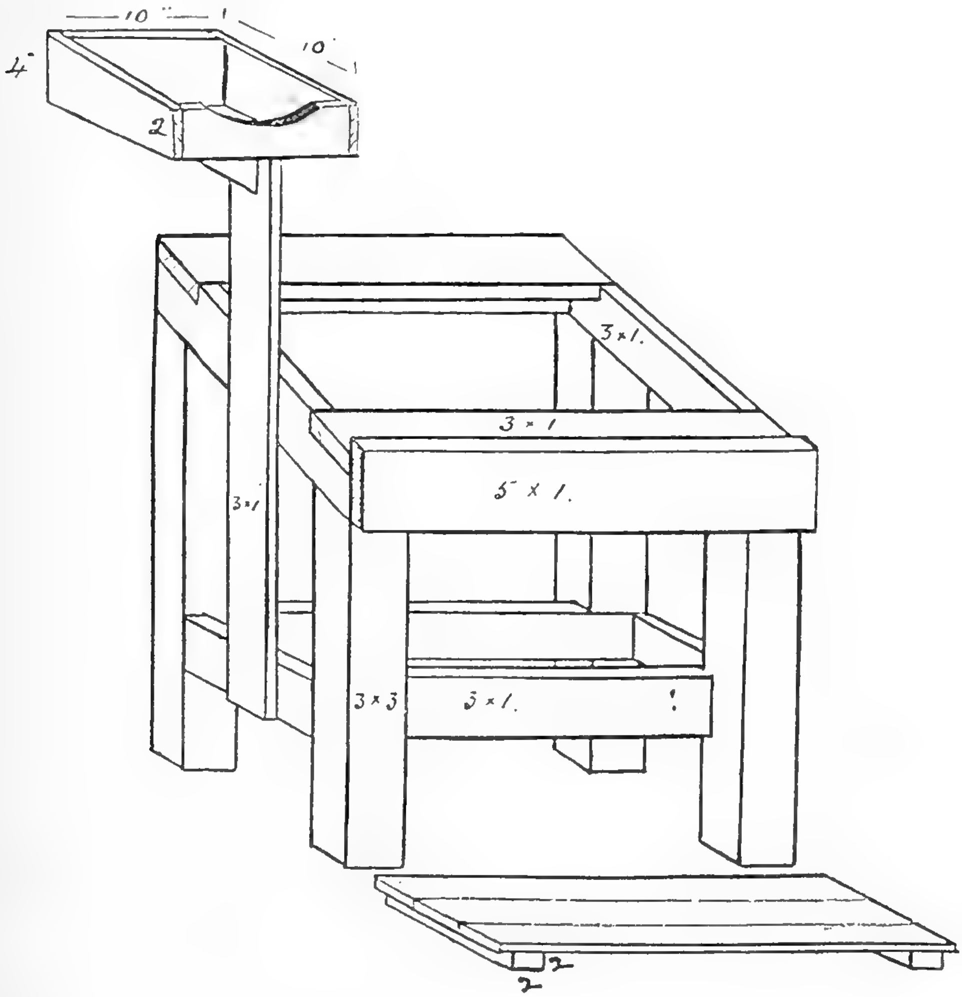


PLATE 161.

Packing Stand with Paper Holder and Spring Board.

This stand is tilted and holds two cases. The tilt assists the packer by keeping the oranges in position. The packer by packing two cases of different sizes at the same time is assisting himself in his sizing.

Fruit is always sized according to the measurement of its diameter, the following sizes being used:—2 inches, $2\frac{1}{4}$ inches, $2\frac{1}{2}$ inches, $2\frac{3}{4}$ inches, and 3 inches. Under the Fruit Act oranges are not allowed to be marketed in Queensland when under $2\frac{1}{4}$ inches in size. The size can be determined by having a set of rings made with these diameters, the orange being placed on the ring with the stalk up. Any orange that will fall through a $2\frac{1}{4}$-inch ring is classified as a 2-inch orange. Likewise, an orange that will go through a $2\frac{1}{2}$-inch ring and not through a $2\frac{1}{4}$-inch is classified as a $2\frac{1}{4}$-inch orange. This method is repeated to determine all sizes. A handy gauge can be cut from a piece of three-ply with a

washer-cutter or carpenter's expansion bit. A few weeks' experience will enable the packer to become so proficient that the use of the rings will become unnecessary. Packers are advised to always pack to a count instead of making up their minds that they will pack to an exact size. When using a mechanical sizing machine best results are obtained by keeping the rollers at a market setting so that the same counts can be packed out of each bin for any particular variety or shape of fruit. After any alteration of the rollers or belts to pack other fruits, the machine can be set back to its original place and the same counts packed from the same bins.

Packing.

The standard diagonal cheek system of packing is best. This pack has the following advantages:—

A given size of fruit will always come to the correct height in the case.

The packed fruit will always look attractive, appearing in straight lines, diagonally, across, and up and down the case, whether opened on the top, bottom, or sides.

No two oranges will rest upon the other, but in the pockets formed between the fruit of the layer beneath.

The height of the fruit in the case can be governed by making the pockets larger or smaller.

The quantity or number of fruit in the case is always the same for each pack, and can be ascertained at a glance.

It is my intention to, as far as is possible, simplify the packing. With this end in view readers will find that the various packs that can be used have been divided into two groups. One group contains a list of packs that will be found by most packers to be all that are necessary to pack all sizes of most types of fruit. The second group consists of intermediate packs which packers might find of use when different types of fruit, such as the Jaffa, occasionally do not come to the correct height in the case when using the packs of the first group. Growers should bear in mind that counts regularly used by the established packing houses are better understood by buyers, and should use these in preference to intermediate counts.

A fault often noticed in private packing sheds is the lack of any attempt on the part of packers to provide themselves with equipment to enable them to work fast and in comfort. Proper equipment in packing sheds soon pays for itself in increased efficiency, enabling a larger output per day to be handled. A pamphlet, "Packing Houses and their Equipment," describing how to make shed equipment, for a small cost, at home during the quiet periods of the year, can be obtained free on application to the Under Secretary, Department of Agriculture and Stock, Brisbane.

By using the packing stand illustrated (*see* Plate 161), the cases are slightly tilted, which helps to keep the fruit in position, thus making the packing much easier. The packer stands with the two cases to be packed into in front of him, with the fruit on one side of the cases and the wrapping paper on the other. The bench with the fruit on should be made tilted to permit the fruit to run to within easy reach of the packer.

The two cases used for citrus packing can be packed correctly by using four different packs. For the Standard box, 18 inches long by 11½ inches wide by 10½ inches deep, the 3—3, 3—2, and 2—2 packs will pack correctly all commercial sizes of fruit. When packing the Dump case the 3—2, 2—2, and 2—1 packs are used. A reference to the packing chart used in conjunction with a description of packs, will assist the beginner in understanding the difference between the different packs.

3—3 Pack.

This pack is only used in the Standard box and is very easy to do if care is taken in placing the first six oranges in the first layer. Three of these are placed in a layer across the end of the case with the stalks facing the end of the case nearest the packers, the first fruit being placed in the left-hand corner and the other two being spaced equal distances apart between the corner fruit and the right-hand side of the box. This leaves three even spaces between the fruit in which we place the next three oranges, forming the 3—3 from which the pack gets its name. This is repeated until the layer is finished. Care must be taken to see that fruit is placed in straight lines. The layer is then completed by placing lines of three in the spaces between each line of fruit until

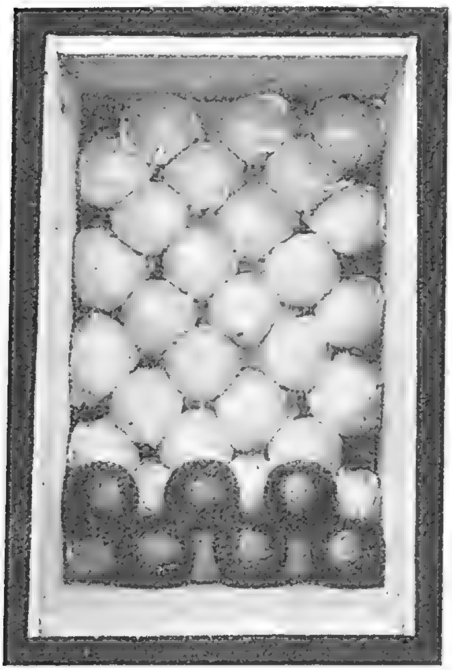


PLATE 162.

SECOND LAYER.

3-3 Pack.

The second layer is started by placing three oranges on the pockets between the first three fruit of the first layer. The layer is completed by placing fruit on the remaining pockets of the first layer.

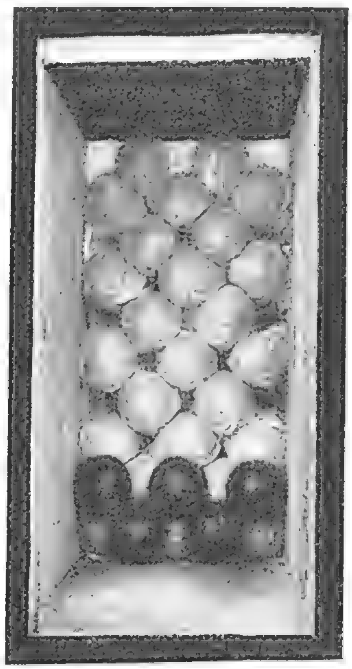


PLATE 163.

SECOND LAYER.

3-2 Pack.

The second layer is started by placing two oranges on the pockets between the first three fruit of the first layer. The layer is completed by placing fruit on the remaining pockets of the first layer.

the last line at the end of the layer is reached. The last three oranges are then placed in position but reversed so that the stalk end is facing the end of the box. The second layer is packed in the same manner as the first, but is placed in the pockets or spaces of the first layer (Plate 162). The same rule of placing the stalk end of the fruit to the wood applies in all of the packs.

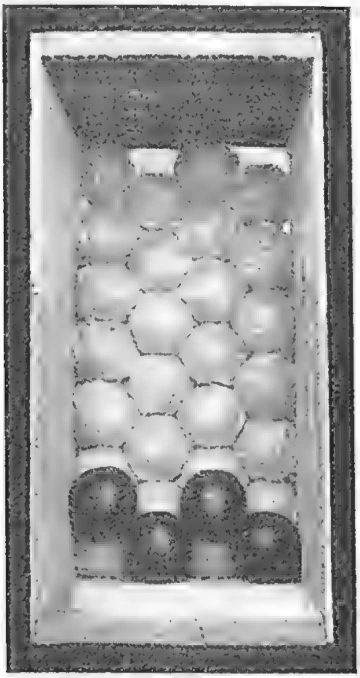


PLATE 164.

SECOND LAYER.

2-2 Pack.

The second layer is started by placing two oranges on the pockets between the first two fruit of the first layer. The layer is completed by placing fruit on the remaining pockets of the first layer.

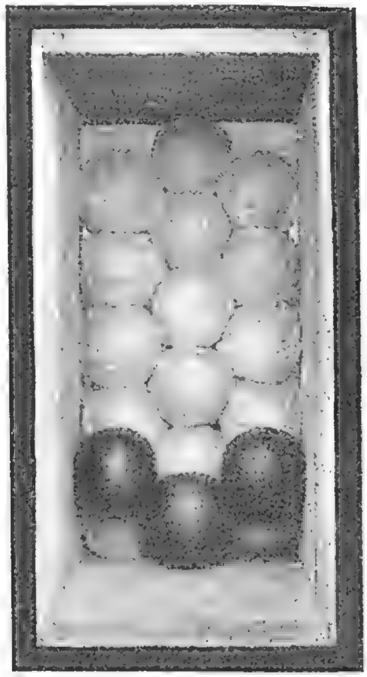


PLATE 165.

SECOND LAYER.

2-1 Pack.

The second layer is started by placing one orange on the pocket between the first two oranges of the first layer, finishing the layer by placing oranges on the remaining pockets.

3—2 Pack.

In the 3—2 pack the first layer is started by placing an orange in each corner of the case and one exactly midway between them facing end to end in the case, the stalks facing the packer. This forms a line of three oranges with two spaces, or pockets, between them. The pack is continued by placing two oranges in these spaces, which leaves three pockets between the two oranges. We repeat the placing of three oranges in these pockets, and then alternately two and three until the layer is finished, except for the last line of fruit; this is reversed with the stalks facing the wood of the case end furthest from the packer. To start the second layer (*see* Plate 163) place two oranges in the pockets formed by the first three oranges of the first layer, then two and three alternately, the stalks facing as in the first layer until all the pockets of the first layer are filled, again reversing the last line of fruit across the case. This process is repeated layer by layer until the case is filled.

2—2 Pack.

This pack is started by placing an orange in the bottom left-hand corner of the case and midway between this orange and the right side of the box a second orange, leaving two pockets between the two in which the next two oranges are placed, thus forming the 2—2 from which the pack derives its name. This is then repeated, the oranges being placed facing as in the 3—2 pack until the layer is finished with all but the last line of fruit. This is reversed with the stalks facing the wood of the case end furthest from the packer. The second layer is started by placing two oranges in the pockets formed by the first two of the first layer (*see* Plate 164), the layer being finally finished by placing oranges in all the pockets of the first layer and reversing the last line of fruit as in the first layer. By repeating this process layer by layer the case is finished. If close attention to the rule of starting the first layer in the left-hand corner is observed the number of layers in the case can be easily counted, the first, third, fifth, and seventh layers starting in the left-hand corner, and the second, fourth, and sixth layers starting in the right-hand corner. Knowing the number of layers there are in the case is of great assistance in separating counts such as the 96 and 112 in the Dump case, in which the layers look the same although the 112 contains one more layer than the 96.

2—1 Pack.

This pack is used only for the Australian Dump case. The same rule of placing the stalk end of the fruit to the wood applies. The pack is started by placing an orange in each corner of the case, which leaves a space between the fruit. A third orange is placed in this space or pocket, which gives us two and one from which the pack derives its name. The same process as with the other packs is then used to complete the layer. The second layer starts with one orange placed upon the pocket between the first two of the first layer (*see* Plate 165), followed by two, one, two, until the layer is finished. The case is completed by repeating further layers in the manner of the first and second layers, packing until full.

A close examination of the packing tables given will be of assistance. These will be dealt with separately for both cases. To simplify the packing as much as possible the packs will be divided into two sections for each case, one table giving the regular packs to use, the second giving the intermediate packs which can be used when the regular packs do not pack a given type of fruit satisfactorily.

Packing the Australian Dump Case.

The dimensions of the Australian Dump case are—18 inches long by $8\frac{2}{3}$ inches wide by $14\frac{1}{4}$ inches deep. The timber for this box should be cut with the sides of a minimum thickness of five-sixteenths of an inch, with the tops and bottoms a quarter of an inch thick. Unlike the Standard box, no cleats are used. The finished case should have a bulge of $\frac{1}{2}$ inch to 1 inch on the top and bottom of the case when packed. Three packs are used to pack this box, the 2—1, 2—2, and 3—2.

TABLE A.

A Simplified List of Packing Counts to be Used for the Australian Dump Case.

Approximate Size.	Pack.	Layer Count.	No. of Layers.	Total.
2¼ inches	3—2	6—6	8	240
	3—2	6—5	8	220
	3—2	5—5	8	200
	2—2	7—7	7	196
2½ inches	2—2	7—6	7	182
	2—2	6—6	7	168
2¾ inches	2—2	6—5	7	154
	2—2	5—5	7	140
	2—2	5—4	7	126
3 inches	2—2	4—4	7	112
3¼ inches	2—2	4—4	6	96
	2—2	4—3	6	84
	2—1	5—5	5	75
3½ inches	2—1	5—4	5	68
	2—1	4—4	5	60
	2—1	4—3	5	53
4 inches	2—1	3—3	5	45

Try on all occasions to pack your fruit with these packs in preference to those in Table "D."

TABLE B.

Intermediate Packs to be Used for the Australian Dump Case.

It is recommended not to use these packs unless it is found that a type of fruit will not come to the correct height when any of the counts in Table "A" are used. On occasions when case ends are cut too wide it will possibly be found that one of these counts will assist to overcome the difficulty.

Approximate Size.	Pack.	Layer Count.	No. of Layers.	Total.
2¼ inches	2—2	8—7	7	210
2½ inches	3—2	6—5	7	193
	3—2	5—4	8	180
	3—2	5—5	7	175
	2—2	7—7	6	168
2¾ inches	3—2	5—4	7	158
	2—2	7—6	6	156
	2—2	6—6	6	144
	3—2	4—4	7	140
3 inches	3—2	4—4	6	120
	3—2	4—3	6	105
	2—1	5—5	6	90
3½ inches	2—1	5—4	6	81
	2—1	4—4	6	72
	2—1	4—3	6	63

Knowing the number of layers in a case at any stage of the packing is a good guide to a packer. By calculating the height the fruit will come to in the case two or three layers before the top is reached, the packer, by applying the rule, "The size of the pockets governs the

height of the fruit in the case," can bring the fruit either higher or lower as necessary. This is done by making the pockets smaller by slightly increasing the size of the fruit, and bringing the fruit higher in the box to correct a pack which will come too low, or, in the case of a pack that is coming high, to open the pockets by reducing slightly the size of the fruit. Usually these faults are caused by a variation in sizing the fruit in the subsequent layers after placing the first layer into position. Cases not of the correct width are often the cause of trouble in bringing to the correct height, but by following the rule governing the size of the pockets this difficulty may be overcome. It should be remembered that it is an offence against the Fruit and Vegetables Act to market fruit in under-sized cases.

Oranges packed in the Dump case should be packed 1 inch to 1½ inch above the top of the case, and when nailed have a bulge of ½ inch to 1 inch top and bottom.

[TO BE CONTINUED.]

NO OPEN SEASON FOR OPOSSUMS.

The Minister for Agriculture and Stock (Mr. F. W. Bulcock, M.L.A.) has announced the decision of the Government to continue the measures in force for the protection of the opossum in this State throughout the present year. This decision was arrived at after full consideration had been given to the various factors incidental to the opening of an opossum season.

For months past, said the Minister, his Department had been closely following developments in the oversea markets, which constituted a primary factor in any decision on the matter. In addition, reports were sought from departmental officials and other reliable sources of information as to whether the number of opossums in the breeding districts of the State was sufficient to justify trapping operations. The latest information available definitely indicates that opossums are not in sufficient numbers in the favoured districts to permit of legitimate trappers securing fair average supplies.

Information obtained as a result of inquiries on oversea marketing conditions shows that a total of approximately 1,520,000 opossum skins were catalogued and sold at the February and April sales held in London this year, and all Australasian supplies were practically cleared. Prices at the February sale showed a hardening tendency on the previous abnormally low averages of the past two or three years, but the figures for the April sale could not be classed as satisfactory, in that, although certain lines were sold at previous prices, a large proportion of the offering showed a distinct decline on figures for the February sale.

Taking the two primary factors into consideration, it is evident that an open season during the present year would not yield the trapper a reasonable return for his outlay and work. The Minister pointed out that although the Government was prepared to exploit every legitimate avenue for employment, it would be recognised that trappers should be afforded protection against operating under conditions which would be distinctly to their financial disadvantage at present.

In referring to the necessity for conserving the opossums in seasons when they are scarce in numbers, Mr. Bulcock emphasised the importance of the industry to the State when he pointed out that the value of the opossum skins obtained during the last four open seasons, aggregating only six months in the period since 1926, reached a total sum of almost £1,500,000.

Passion Fruit Culture in Queensland.

By H. BARNES, Director of Fruit Culture.

THE principal passion fruit grown commercially in Queensland is the common purple variety, *Passiflora edulis.* Other varieties have been tried from time to time, but have not proved sufficiently successful to warrant their general cultivation.

The passion vine is a climber and thrives best in the warm moist atmosphere of the tropics and sub-tropics. It requires constant attention by way of cultivation, pruning, and spraying for best results. It is a fact that the vines grow vigorously in our scrubs without care or attention and yield crops without trace of disease. When, however, the vines are domesticated, growing conditions are entirely altered. In the natural state the vines are isolated from any source of disease infection, and, further, their growth does not become as congested as it does when grown on a trellis. The production of dense masses of foliage is favourable to the development of diseases to which vines are so subject.

The usual features required to be taken into consideration when selecting a site for an orchard are also necessary when determining an ideal situation for growing passion fruit. Two of the main factors to consider are aspect and soil.

With regard to the aspect, a gentle slope to the east or north-east, sufficiently elevated to be above frost level and well sheltered from heavy winds, is best.

Good scrub or forest loams possessing good natural drainage will produce good crops. Comparatively poor soils will also grow good passion fruit if they are well drained and are systematically manured and kept well cultivated. Vines will not thrive in sour soil conditions. Stagnant water at the roots is fatal to them; for this reason it is not advisable to select very heavy soils.

Cropping Habit.

The passion vine bears its fruit on new growth. The time of first fruiting varies considerably, depending chiefly on the season of planting. As a general rule, however, when the vines are planted in the early spring, the first crop will be harvested in from twelve to fifteen months. When autumn planting is adopted the first profitable crop is generally borne the following summer twelve months, that is, eighteen to twenty-one months after planting.

As a rule two crops are borne yearly—a main summer crop and a secondary winter crop—though intermediate crops are at times obtained. Two to three months elapse from the time of the setting of the fruit to maturity. Under average conditions the vines flower during August, September, and October for the summer crop, which is harvested during November, December, and January. An intermediate flowering may occur about November or December, giving an autumn crop; whilst for the winter crop the vines flower during February and March and the crop is harvested during May, June, and July.

During particularly favourable growing years the vines may be in almost continuous growth, and consequently will ripen fruit practically all the year round; such, however, is not the general rule.

The profitable life of the vine is about four years when grown under proper cultural conditions. Maximum cropping is obtained with the second summer crop, following which the tendency is for the vines and the quality and appearance of the fruit to gradually deteriorate. Reasonably good crops can, however, still be obtained for another year or two.

Preparation of the Land.

Two much stress cannot be laid on the importance of thoroughly preparing the land prior to planting. The soil should be ploughed deeply and reduced to as nearly a perfect tilth as possible in order to provide the best soil conditions in which to grow the young plants. No amount of subsequent cultivation can make up any deficiency in preliminary preparation. Deep working makes a greater body of soil available from which the roots will be able to absorb plant foods, and also ensures better drainage.

Propagation.

Plants are easily raised from seeds or cuttings, though the former method is almost generally adopted and is recommended.

In connection with the selection of seed, it should be remembered that passion fruit are subject to several serious diseases (information concerning which can be obtained from the Chief Entomologist of the Department of Agriculture and Stock), and it is possible that these diseases can be transmitted per medium of the seed. Intending planters are therefore advised to obtain only perfectly formed fruits which have been allowed to mature fully on vigorous healthy vines. If the pulp is removed from the fruit and placed in a vessel of water for several days to ferment, the seeds may be easily separated from the mass. They should then be well washed in clean water and dried in the shade.

If early spring ripened fruits are selected and the seeds planted immediately, seedlings will be ready to plant out during the summer or autumn. If plants are required for spring planting (which period is preferable) seeds can be selected from fruit maturing in the late summer or autumn; if planted then seedlings will be available for planting the following spring.

The seeds should be sown in a specially prepared seed bed composed of light soil and leaf mould. They should be set half to three-quarters of an inch below the surface, and the soil should then be firmly pressed and subsequently mulched lightly with well-rotted manure. The bed should be sheltered from the sun and kept judiciously watered. In three to four weeks the young seedlings will appear, and as they develop they should be thinned out to about four inches apart, whilst the shade can be gradually removed.

Transplanting.

When the plants are about twelve inches high they may be planted out in the vineyard. Removal of the plants from the seed bed will be facilitated if the bed is given a thorough soaking before digging the plants; this will enable them to be lifted without excessive injury to the roots. Care should be exercised at all times when transplanting not

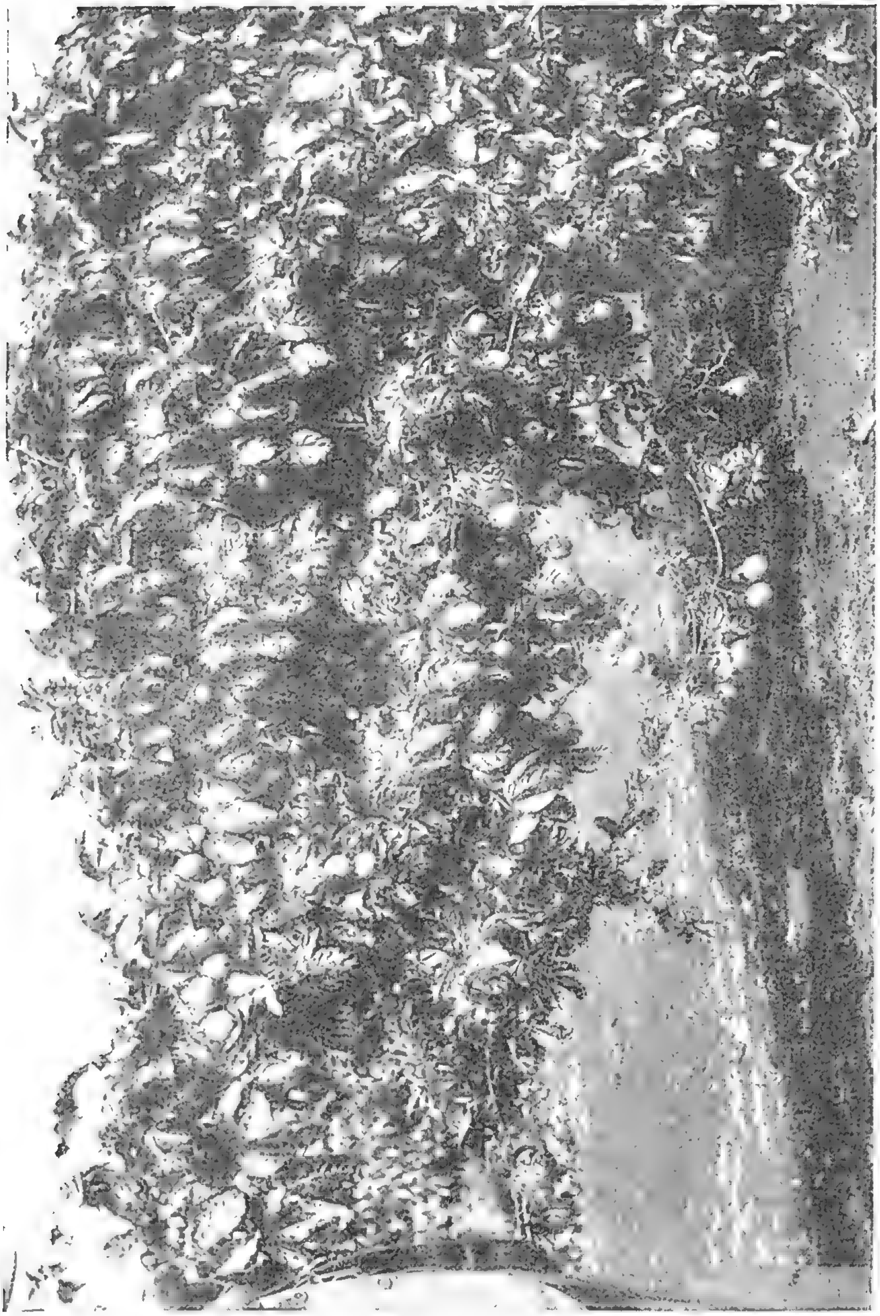


PLATE 166.—PASSION FRUIT VINE.
Showing fruiting habit.

to expose the roots to the sun and dry air which will quickly dry them out; keep them covered with damp sacking until they are ready to plant. If the tops of the plants have made excessive growth it is advisable to cut them back to about twelve to fifteen inches high in order to reduce evaporation of sap and avoid any tendency to wilt. Holes where the plants are to be set under the trellis should be dug in readiness. The soil round the roots should be well firmed and a quantity of water applied to each plant before the holes are completely filled in. If the weather is at all dry the plants may need to be given one or two further waterings at weekly intervals, following which ordinary cultural methods should fulfill all requirements.

Trellising and Planting.

Prior to planting the land should be marked off in rows about ten feet apart. The rows should run as nearly as possible north and south so that the plants may benefit from the sun's rays on both sides. If the vineyard is on a steep hillside, however, the contour of the land may play a considerable part in determining the direction of the rows. If the site selected is subject to washing during heavy rains the rows may be planted across the slope and provision made for contour drains to prevent as far as possible loss of surface soil by erosion.

Trellises consisting of good fencing posts should be erected along the rows, the posts being set 15 feet apart with their width across the row. Good sized posts are 8 inches wide by 3 inches thick by 7 feet 6 inches long; they should be set 18 inches in the ground, leaving 6 feet above the surface. The end posts should be much heavier, and should be well strutted and set 2 feet 6 inches deep, as they have to act as strainers and prevent the wires from sagging when they have to carry a heavy growth of vine. If the rows are very long it is advisable to have intermediate strainers about every 80 yards, or spreaders may be used to support the weight.

Two systems of wiring are in use, the first known as the parallel system in which two No. 8 galvanised wires are firmly fixed to the tops of the posts, one on each side, so that they form horizontal parallel lines about 8 inches apart, and the second known as the vertical system in which one wire is fixed to the top of the posts and the other placed about 15 to 18 inches below it. Each system has its advantages and disadvantages, but it is considered that the "parallel" system is the best for general adoption in this State.

If any grower favours the vertical system, four main leaders may be left, the first two being trained one each way on the lower wire and the remaining two on the top wire. One disadvantage of this system, however, is that, where growth is very vigorous, the laterals from the leaders on the top wire tend to smother the growth on the bottom wire and exclude the necessary light and air, thereby promoting the development of diseases. The system is probably better suited to vines grown on poorer land where the growth is not so vigorous and the foliage less dense.

The seedlings should be planted midway between the posts—*i.e.*, 15 feet apart. In two or three weeks following transplanting the vines will be in vigorous growth and will develop a number of laterals and shoots from around the crown of the plants at ground level. All should at first be allowed to grow until they are 18 to 24 inches long. The

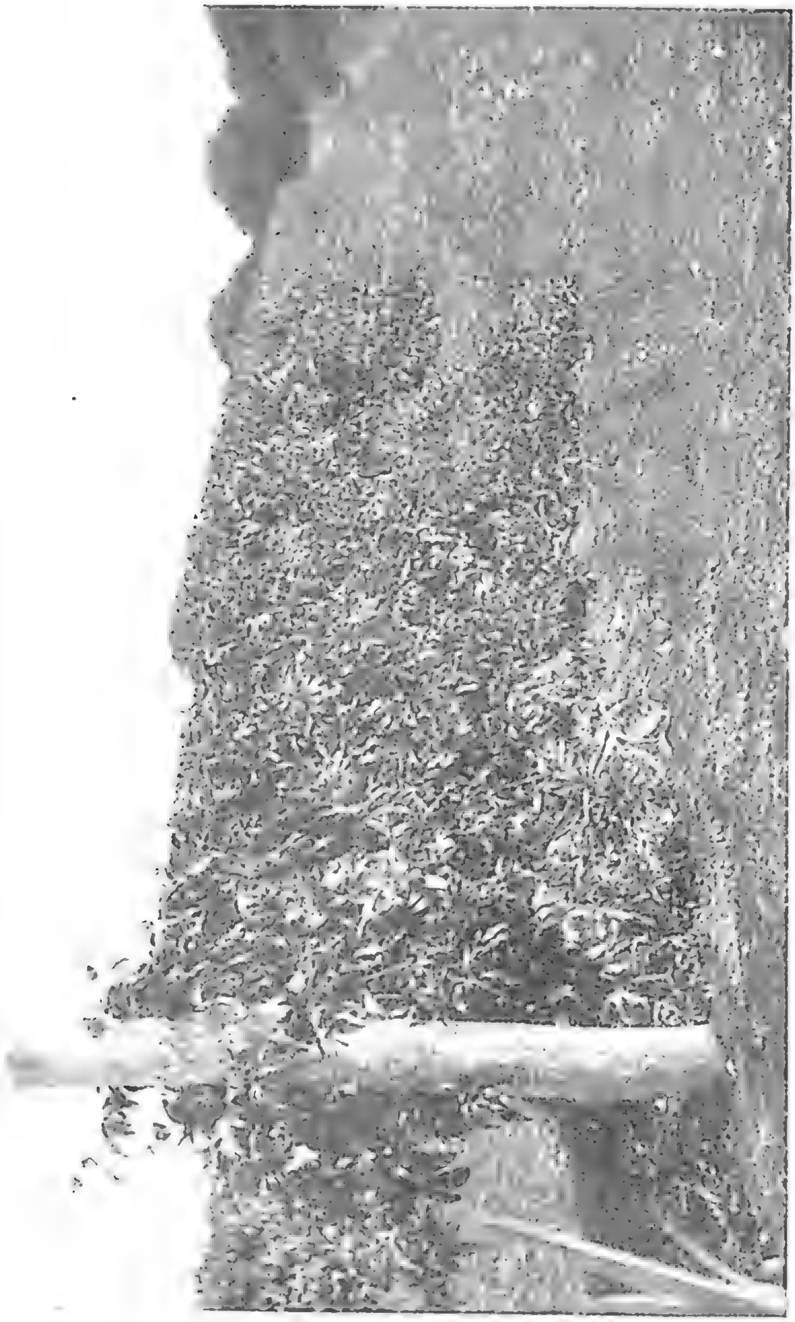


Plate 167.—Passion Fruit Vine.
Showing how the plants drag on the ground when grown on low trellis.

most vigorous growth should then be selected to form the future stem of the vine, and all the remaining shoots including the original stem should be cut away. The single stem selected should be tied to a light stake fixed firmly in the ground, and tied at intervals until it reaches the height of the trellis. The terminal bud should then be pinched out and two main leaders induced to develop. These are trained one each way along the wires until they reach the posts midway between the adjoining vines, when their further growth should be stopped by again pinching out the terminal buds. All branches developing from the main stem between the ground and the height of the trellis should be suppressed. Lateral branches will develop from the main leaders all along the wires, and these should be allowed to develop at intervals of about 9 inches. The laterals should be trained alternately over the two parallel wires and allowed to hang down. In this way the weight of the vine is distributed over the two wires. It is claimed at times that the vines give better results if trained only in one direction on the wires, but except in instances of rows planted up and down the slopes of hills (in which case it is found that the vines grow more vigorously up hill than down), the practice does not appear to have any advantage over the two-way system.

Pruning the Passion Vine.

Although there is no record that the pruning of the vine will increase its annual cropping capacity, it is nevertheless advisable to perform a certain amount of cutting back with the object of—firstly, keeping the vines healthy; secondly, inducing a growth of vigorous healthy wood on which good fruit will be borne; and thirdly, to bring in the crops at different periods of the year when better prices are realisable. The susceptibility of vines to certain diseases renders it necessary for them to be kept open to permit free penetration of light and air, and in order that they may be more effectively covered with preventative sprays.

It is never advisable to prune passion vines very severely. Vines so treated, if they survive, at times have a tendency to become shy-bearing. It is also important to remember that only very light thinning-out should be resorted to during dry weather.

It is a difficult matter to lay down in detail a set method of pruning, as each vine is likely to present a new problem which must be solved on the spot. Generally, however, all dead and diseased wood should be removed, long straggling laterals should be cut back to keep them clear of the ground, and where the growth has become dense and tangled the secondary laterals may be cut back to nine to twelve inches from the primary laterals which develop from the main leaders on the wires. All weak and spindly growths should be entirely removed, as such cannot produce good fruit. Pruning is a tedious work, but nevertheless it should be carefully done and every cut made with a definite purpose.

Most fruit trees are pruned during the winter time when growth is dormant, but as this is usually a dry period and, as has been mentioned previously, only light thinning is advisable at such times, the main pruning of passion vines is best carried out about the end of January and February after the main summer crop has been harvested. Rains are usual at this time of the year, which will assist the vines to put forward new growth for the second or winter crop, and the risk

of injury to the vines is not so great. Light pruning only should be done during a dry winter, the months of July and August generally being considered the best time.

The bulk of the main or summer crop of fruit is harvested during December and January, with the result that market prices at this time fall very low. Those growers who are particularly favoured by having the vineyard situated in a warm locality may take advantage of the fact that, provided the soil is well supplied with moisture, vines may be forced into growth at any time by pruning. If the vines are pruned earlier than usual for the summer crop they are likely to mature early fruit which will reap the benefit of the better prices obtaining before the main crop is harvested.

If the grower wishes to produce an extra big crop during the autumn or winter months, the summer crop must be sacrificed by pruning back the flowering secondary laterals to within nine to twelve inches. If a big summer crop is desired the winter crop must similarly be sacrificed.

Fertilizing.

The passion vine is a heavy feeder, and, whilst fertile virgin land may not need fertilizing for the first year or so, poorer soils should be fertilized from the outset. The Agricultural Chemist in his booklet "Complete Fertilizers for Farm and Orchard" recommends the following manure for passion fruit:—

"Use per acre, in accordance with the quality of the soil a mixture of—

1 to 2 cwt. nitrate of soda;

4 to 8 cwt. blood and bone manure;

1 to 2 cwt. superphosphate; and

1 to 2 cwt. sulphate of potash.

A top-dressing with 1 cwt. of nitrate of lime or nitrate of soda in spring will be found beneficial."

OTHER VARIETIES.

Passiflora laurifolia—"Bell Apple."

The Bell Apple is not grown to any extent in this State, though its fruit is quite edible. It is regarded more as a vigorous and handsome creeper than as a producer of fruit for market, and its cultivation for the latter purpose is not recommended. Without hand fertilizing it is prone to be shy-bearing.

Passiflora ligularis—"Mexican Passion Fruit."

This variety is of no use for commercial purposes as the pulp is absolutely without flavour.

Tacsonia mollisima—"Banana Passion Fruit."

The Banana Passion Fruit has been tried in this State, but the demand for the fruit is very poor, and it is consequently not worth growing. The matured fruit is elongated in shape, yellow in colour,

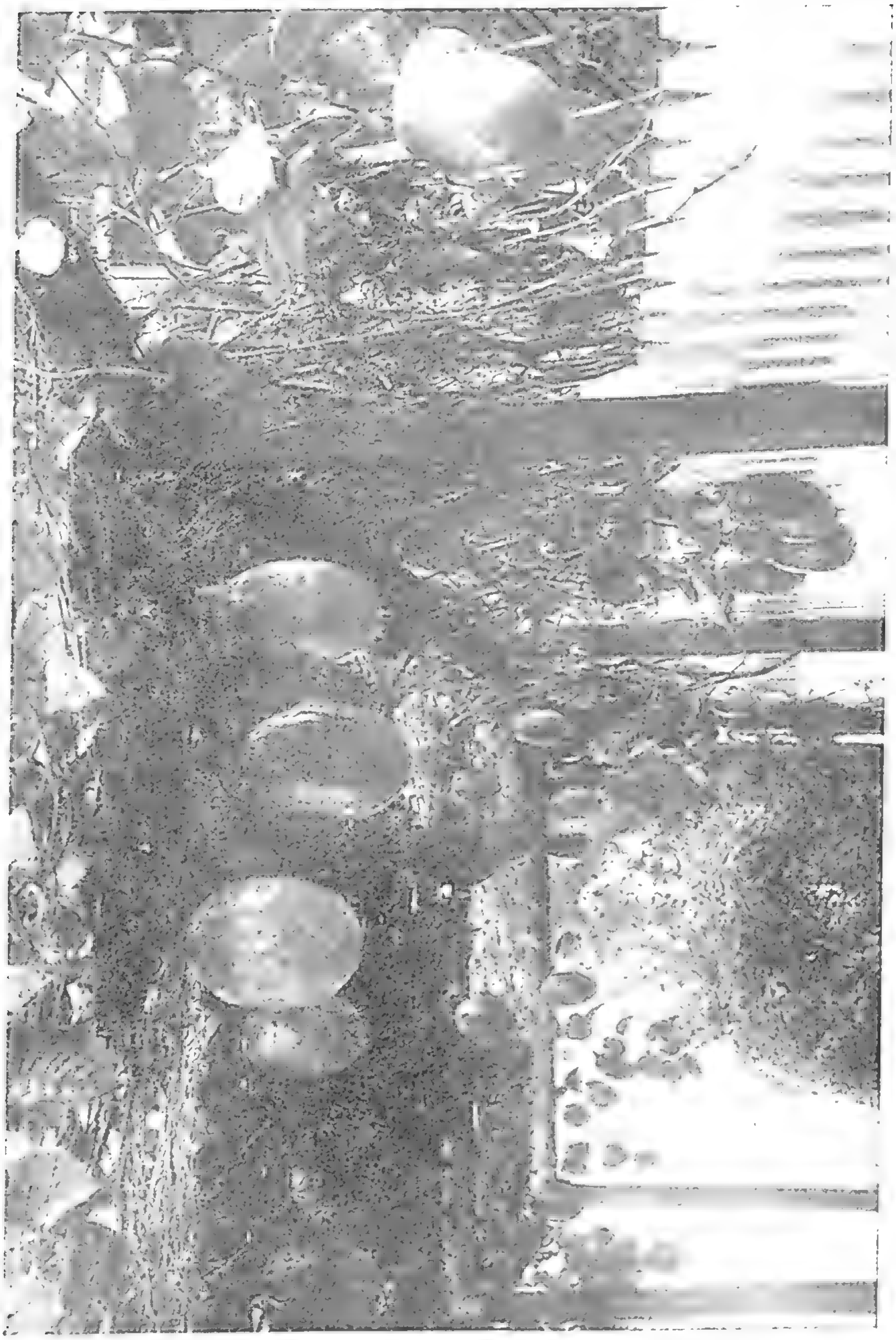


PLATE 168.—GRANADILLA PASSION VINE, TARINGA, NEAR BRISBANE.

and possesses a delicate skin. The flower is a pretty shade of pink and makes a splendid show when the vine is grown for ornamental purposes.

Passiflora macrocarpa—"Granadilla."

This variety of Granadilla can be grown practically anywhere on the coast of Queensland in warm situations. The fruit, as the name signifies, is very large, frequently weighing several pounds. The seed cavity is small for the size of the fruit, and is surrounded by a thick layer of whitish flesh of no particular flavour, but which, when flavoured with lemon, &c., may be used for pies. The plant is best grown on a lateral trellis.

Passiflora quadrangularis—"Granadilla."

This variety, which thrives in the tropical conditions of the North, is a smaller fruit than *P. macrocarpa* of a somewhat irregular oblong shape, about 4 to 4½ inches in diameter and 6 to 9 inches long. When fully ripe this is one of the most highly flavoured of all tropical fruits, and is much relished by those who know it. The cavity is large, and is filled with large seeds surrounded by a pale yellow pulp. Maturity is indicated by the softening of the flesh and the changing of the pale green colour to a dull yellowish green. Cultivation is similar to that of *Passiflora edulis,* and for preference the vine should be trained on an overhead trellis.

The Granadilla, when grown in Southern Queensland, often proves to be shy-bearing. The flowers are protandrous—i.e, the pollen of the anthers is ripe before the stigmas are ready to receive it. The pollen of younger blossoms is therefore necessary to fertilize the older flowers. Insects flying from one flower to another may carry the pollen with them and effect the required fertilization, but in the absence of insects hand pollination must be resorted to. A small camel-hair brush provides a ready medium for the transference of the pollen.

THE PREMIER'S MISSION TO GREAT BRITIAN.

THE Premier, Hon. W. Forgan Smith, remarked in the course of a message from London on the progress of his mission on behalf of Queensland producers that he had seen the British Minister of Agriculture (Right Hon. Walter Elliot), who advised him that the British Government had no intention of endeavouring to impose any quota on Australian dairy produce. Mr. Forgan Smith also has an assurance from the Imperial Authorities that no attempt to interfere with the preference on sugar would be made during the currency of the existing agreement, which still has about two years to run. He hoped to have further conversations on the subject before his departure from England on 7th July. The Premier went on to say that the British feeling towards Australia was marked and friendly, and the public generally held Australians in high regard. Queensland was favourably known, and he had been received kindly on every side.

Australian Nut.

By E. H. GURNEY, Agricultural Chemist.

DURING the past two or three years increased interest has been taken in the planting and cultivation in Queensland of the Australian Nut (*Macadamia ternifolia*). This nut was previously known under the name of Queensland Nut.

Therefore, it was thought that the publication of analyses, conducted in the Agricultural Laboratory of the Department of Agriculture and Stock, of a few samples of this nut, would be of interest and value for purpose of comparing any alteration that may occur in composition of the nut, due to introduction of any particular new strain or new cultural procedure.

The three analyses in the following table were made upon samples received in 1926, and were grown by Mr. J. F. Waldron, Upper Eungella, Tweed River, New South Wales. These analyses appear in the 1925-1926 annual report of the late J. C. Brünnich, Agricultural Chemist. It will be noted that No. 1 sample was not fully ripe and the kernel is shown to contain a very high moisture content. The green hulls of this sample were found to contain 4½ per cent. of tannin. The above-mentioned report contains the following statement:—

> "It will be noticed that, although the kernel of the thin-shelled variety is somewhat smaller than that of the ordinary variety, the percentage weight of the kernel is very much larger, so that 1 lb. of the thin-shelled nuts yields 6½ oz. of kernel, as against 4¼ oz. of kernel in 1 lb. of the ordinary variety."

——	No. 1. Thin-shelled Nuts with Hull rather Green.	No. 2. Thin-shelled, Hull Ripe.	Ordinary Variety with Hull Ripe.
Average weight of hull (grms.)	8·7	..	9·75
Average weight of nut (grms.)	8·2	7·8	14·8
Average weight of shell (grms.)	4·8	4·7	10·8
Per cent. shell	58·7	59·9	73·2
Average weight of kernel (grms.)	3·4	3·1	4·0
Per cent. kernel	41·3	40·1	26·8
Analysis of kernel—			
Moisture per cent.	28·2	6·1	11·8
Protein per cent.	8·9	8·7	8·6
Oil per cent.	52·8	72·7	70·0
Carbohydrates and fibre, per cent.	8·2	10·5	7·1
Ash, per cent.	1·9	2·0	2·5

The following table contains analyses of samples of the Australian Nut grown in Queensland in 1933. Sample No. 5030 was forwarded by Mr. J. Oxenford, Oxenford, and the other three samples, Nos. 949, 950, and 951, were grown by Mr. W. R. Petrie, Petrie. Each of these

samples of Mr. Petrie were picked from one tree only and all trees were grown on forest land without fertilizers.

—	Variety, Laboratory No., and where Grown.						
	5030 Oxenford.	949 Petrie "Pearl."		950 Petrie "Planet."		951 Petrie "Red Windsor."	
Kernel	26·2%	42%		31%		32%	
Shell	73·8%	58%		69%		68%	
Average weight of kernel (grms.) ..	2·2	3·15		2·43		2·35	
Average weight of nut (grms.) ..	8·4	7·50		7·84		7·34	
	Kernel.	Kernel.	Shell.	Kernel.	Shell.	Kernel.	Shell.
	%	%	%	%	%	%	%
Moisture	5·1	3·01	10·39	2·92	10·73	3·01	10·98
Protein (N × 6·25)	7·4	7·13	1·66	8·885	1·75	10·11	1·66
Total Sugars ..	4·0	6·51		3·68		6·02	
Other Carbohydrates by diff. ..	8·3	5·83	21·04	5·32	23·75	5·39	23·03
Starch	Nil	Nil	..	Nil	..	Nil	..
Oil (Petrol Ether Extract) ..	71·4	73·68	0·28	75·44	0·32	73·04	0·32
Fibre	2·3	1·96	65·75	2·04	61·15	1·00	63·15
Ash	1·5	1·88	0·88	1·75	2·30	1·43	0.86
Containing—							
Lime (CaO) ..	0·11	0·44	0·12	0·16	0·15	0·19	0·13
Magnesia (MgO)	0·22	0·19	0·02	0·18	0·06	0·19	0·06
Potash (K_2O) ..	0·49	0·80	0·12	0·65	0·18	0·25	0·17
Phosphoric Acid (P_2O_5) ..	0·48	0·43	0·06	0·49	0·07	0·43	0·04
Refractive Index of Oil at 40°C. ..	..	1·4605		1·4605		1·4597	

The oil in each sample was clear, light in colour, and of pleasant odour.

The analysis of the hulls of sample 5030 is given below expressed as percentage of the hull.

	Per cent.
Moisture	17·7
Nitrogen	0·60
Ash	3·7
Lime (CaO)	0·17
Magnesia (MgO)	0·20
Potash (K_2O)	1·85
Phosphoric Acid (P_2O_5)	0·17

When extracting the kernel from the shell upon a commercial scale, there is a certain amount of the kernel left with the shell; therefore, to determine the composition of the screenings and sweepings of the broken shells, Mr. J. C. K. Sibbald, vice-president of the Australian Nut

Association, forwarded samples of such shell sweepings, and shell free from kernel. The analyses of these samples are given below.

—	Laboratory No. 1808 Screenings and Sweepings.	Laboratory No. 1809 Shells.
	Per cent.	Per cent.
Oil	10·29	1·41
Nitrogen	·48	·28
Protein (Nitrogen × 6·25)	2·98	1·75
Ash	2·01	·95
Containing—		
Lime (CaO)	·36	·16
Phosphoric Acid (P_2O_5)	·34	·09
Potash (K_2O)	·14	·17

Land for Grazing Selection.

LANSDOWNE RESUMPTION.

PORTION 3, parish of Westbourne, Blackall Land Agent's District, comprising resumption from Lansdowne Holding, is situated about 80 miles south-easterly from Blackall, and comprises an area of about 21,640 acres. The portion will be opened at the Land Office, Blackall, on Thursday, 12th July, 1934, for Grazing Homestead Selection for a term of lease of twenty-eight years, and at an annual rental of threepence per acre for the first seven years of the term.

The portion consists of open, well-grassed Mitchell and blue grass country, lightly timbered, and is good wool-growing and fattening country. Water supplies are obtained from three tanks and the supply is sufficient. Other improvements comprise fencing.

The selection will require to be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years, and proof must be furnished of the financial standing and pastoral or land experience of the applicants. The selection will be subject to a special condition that it be enclosed witth a rabbit-proof fence within three years from the issue of the license to occupy.

Free lithographs and full particulars may be obtained from the Land Agent, Blackall, the Land Settlement Inquiry Office, Brisbane, and the Government Intelligence and Tourist Bureaux, Sydney and Melbourne.

Agricultural Notes.

By H. S. HUNTER, Agricultural Branch.

WELL distributed autumn rains have assured a good winter in most of the agricultural areas. Grass is in abundance in the dairying country, especially near the coast, and these pleasant conditions should continue until heavy frosts harden the bite. Fodder crops are making excellent growth, and dairy farmers who found it possible to cultivate an ample acreage should have no need to worry about any shortage at the bucket white the cold weather is on.

Cereal Crops.

Beyond the Range the May rains came at an opportune time for the sowing of wheat and other winter-growing cereal crops. Grain growers now are very active sowing. The rains have induced a good growth of herbage, which will be of considerable value to the dairyman and sheep raiser.

Before last month's rains the early-planted wheat crops on the Downs could not be grazed owing to the risk of uprooting them, but these crops now are being grazed heavily. As a result of this feed being available there has been an increase in the output of dairy produce at most of the Downs factories, in contrast to the Lockyer and other inter-coastal districts, where the grazing of cultivation paddocks is not practised to the same extent.

The Cane Crop.

The sugar-cane crop in the far Northern areas did not show much progress during the past month; soil moisture conditions were favourable, but temperatures were relatively low. In the Burdekin area the crop continued to advance satisfactorily, but a continuance of dry weather has rendered irrigation necessary. The Mackay crop made slight progress under the dry and cool conditions experienced, while the crop in the southern areas improved steadily, due largely to favourable soil moisture. In all areas it is anticipated that arrowing of the crop will be heavy; many fields have already flowered, and such crops will, therefore, put on no further growth.

Crop estimates are now being made, and the projected yields for the 1934 crop will be available at an early date.

General Farming Outlook.

The dry weather of March was not without its compensations. Reports from the several centres on the Darling Downs and the Burnett and Moreton districts indicate that full advantage was taken of the conditions then obtaining to cure large quantities of excellent quality hay from the lucerne and Sudan grass crops.

The result is that many farms have good stocks of this valuable fodder stored for feeding to live stock during the winter, or as a set-off against a possible dry spell in the early spring. In these times fodder conserved on the farm is the more valuable because of the fact that most holdings are stocked to full capacity and, in some instances, above the margin of safety in an endeavour to offset low prices by increased production.

In the South Burnett district record quantities of lucerne hay have been made, and silos, which are reported to have remained empty for years, have been filled again. In addition, oats and barley have been planted extensively for winter feed.

The Central Burnett district is nearing the completion of one of the best and longest dairy seasons in its history, and the local butter factories have broken their previous records of output of dairy products. All stock are in excellent condition for the winter, feed is plentiful, and there is an abundance of stored fodder on the farms.

The remarks relating to Southern Queensland generally may be applied also to the central division. Live stock are in good condition for the winter, and the improved seasonal conditions have encouraged farmers to prepare fairly large areas for planting with wheat and winter fodder crops. Wheat is not grown extensively for grain production in the central division, although in the past crops in the Dululu and Theodore districts have yielded good quality grain when the seasons have favoured the crop.

Draught Horses in Demand.

Throughout the farming districts there is a keen demand for draught horses of good quality. This demand has existed for some considerable time, and as a result Clydesdale studs are being strengthened by the introduction of high-priced sires from the Southern States. Good quality working draughts, fillies, or geldings command up to more than £30 per head at the Toowoomba horse sales.

Business in Butter.

Since the Commonwealth Dairy Produce Act came into operation on 1st May, the wholesale home consumption price of butter in all States has been fixed at 140s. per cwt. This has provided welcome relief to producers in the Southern States, as the price, for the first time in many years, will be on a level with that operating in Queensland. This price during May will apply to only 45 per cent. of the Australian production, as an export quota of 55 per cent. has been fixed under the Act for that month. At the time of writing the wholesale price for Australian butter on the London market is in the vicinity of 70s. per cwt. The Australian Dairy Produce Export Control Board has decided that the existing 20 per cent. restriction on butter exports to the United Kingdom shall be discontinued.

BLOAT IN CATTLE.

A well known dairy farmer writes (28-4-34):—"One time in my heard of cows there were four cows that had to be taken to the yard about 4 p.m. nearly every day while the clover was good because they were blown. I had some sticks, with ropes attached, that were put in their mouths ready for them. The ropes were to go round the head to keep the sticks in place. As soon as the cows belched wind I knew they were safe. Since then I have found out that a chain is better than a stick, and it must be as loose as it can be but not loose enough for the cow to get it out of its mouth. I have never dosed a cow for this and never had to use a trocar and have not lost any by blowing on clover or lucerne."

LIST OF REGISTERED STALLIONS.

Subjoined is a list of stallions in respect of which Certificates of Registration were issued under "*The Stallions Registration Acts,* 1923 *to* 1932," during the year 1933-34.

BLOOD STALLIONS CERTIFICATED FOR THE YEAR 1933-34.

Name.	Description.	Age.	Owner.
Addenda	Brown	3	G. Fogarty, Toowoomba
Amberheart	Bay	4	C. Phillott, care of A. G. Anderson, Hendra
Arboreal	Bay	3	M. Ryan, Ascot Chambers, Edward street, Brisbane
Armlic	Bay	4	W. R. Downing, Moolboolaman, Mount Perry Line
Arundel	Bay	5	P. Docherty, Merlin, Prairie
Bachelor's Echo	Bay	4	W. May, Clifton
Bachelor's Heir	Chestnut	3	K. Brennan, Boonah
Bachelor's Lodge	Bay	3	A. McAlpine, Cambooya
Bay Crystal	Bay	3	W. J. Langmore, Jondaryan
Black Guard	Brown	3	E. H. Mannion, West street, Rockhampton
Bob's March	Chestnut	Aged	J. W. Collins, Beaudesert
Boropolis	Bay or brown	3	P. J. Carroll, Newmarket street, Hendra
Brown Peter	Brown	3	Forest Vale Station, Mitchell
Byramjee	Brown	3	C. Bonham, care of C. O'Connell, Hendra
Centauri	Chestnut	4	F. E. Cobbold, care of A. G. Anderson, Hendra
Colloseum	Chestnut	3	W. Glasson, Umbiram
Dalmain	Bay	3	A. P. Gibson, Boolboonda
Dennis Lad	Chestnut	3	G. E. Crane, Elbow Valley, Warwick
El Joven	Bay	3	E. L. Ramsay, Cambooya
Exaltation	Brown	3	I. Freedman, Brunswick street, New Farm
Flying Painter	Bay	3	W. T. Gillies, Cooyar
Forecona	Grey	3	R. J. Spence, Muttaburra
Grand Revel	Bay	Aged	E. W. Sauer, Gayndah
Gunborough	Black	3	T. Kidd, Windorah
Guy Fawkes	Chestnut	3	J. P. Walsh, Mount Perry
Happy Returns	Bay	3	E. W. Walker, Oakey
High Exchange	Bay	4	W. H. Reynolds, Winchester street, Hamilton
High Gain	Brown	3	White and Rees, Surat
High Score	Brown	3	W. H. Anderson, care of A. G. Anderson, Hendra
High Standard	Brown	4	J. W. Wallace, Doncaster street, Toowoomba
Jehad	Chestnut	3	W. G. Hein, James street, Howard
Jokulsa	Black	3	E. L. Ramsay, Cambooya
Kelloshiel	Bay	4	H. B. Rankin, Tiree, via Aramac
Kengoon	Bay	3	A. G. Anderson, Hendra
King Baralong	Bay	3	D. C. Cameron, Le Geyt street, Windsor
Kintrockat	Brown	4	E. L. Ramsay, Cambooya
Layman	Chestnut	3	J. Redman, Wondai
Leolita	Bay	3	T. Jennings, Greenmount
Mane Berd	Bay	3	Derlin and Tilley, Kalbar
Marco Day	Brown	3	W. H. Richards, Pelican, Chinchilla
Meleager	Brown	3	M. Ryan, Ascot Chambers, Edward street, Brisbane
Modestre II.	Brown	5	A. E. Charles, Warrington, Inglewood
Mr. Speaker	Bay	4	T. J. Brosnan and I. J. Moore, Hendra
Night Piper	Brown	4	L. R. Lay, Prince street, Ascot
Oregyn	Chestnut	4	A. Adie, Childers
Pantheism	Bay or brown	4	W. Mace, Torilla Station, *via* Rockhampton
Pat Clyde	Bay	4	A. R. Taylor, Cecil Plains
Poitrel's Will	Bay	3	R. Betts, Boonah
Prince Fox	Brown	4	W. Donovan, Belah, Inglewood
Quertoi	Chestnut	Aged	D. Brennan, Jimboomba
Real Flyer	Brown	3	W. A. Tucker, Bowley street, Hendra
Rightaway	Brown	4	E. E. D. White, Charters Towers
Scotch Force	Bay	3	B. Wagner, care of Marylands, St. Lawrence
Seaforth	Chestnut	4	L. A. Mackenzie, Dingo
Sea Laddie	Bay	3	J. Cunningham, Furmiston, *via* Warra
Serewick	Brown	3	T. J. Campbell, Kolonga, Gin Gin
Sir Bluewin	Brown	3	M. Brosnan, Dragon street, Warwick
Soft Step	Brown	3	W. J. Tucker, Bowley street, Hendra
Southern Don	Chestnut	3	D. A. Proctor, Glen Valley, Byrnestown
Spearall	Brown	5	P. J. Mayne, Forest Park, Warwick
Star Deer	Dark-bay	4	W. J. Noud, Kent street, Hamilton
Strange Idea	Dark-chestnut	4	A. G. Anderson, Hendra
Syce Lad	Bay	4	E. Wallace, Cania, *via* Monto
Warwick Eye	Black	3	G. Reinke, Minden
Windborough	Bay or Brown	3	W. B. Beal, Harriman Park, Cunnamulla
Wittabius	Chestnut	3	C. Bergmann, Witta
Wydells	Bay	Aged	J. E. Fox, Collinsville
Young Maloola	Brown	4	P. Jeppson, Paterson, N. C. L.

TROTTER STALLIONS CERTIFICATED FOR YEAR 1933–34.

Name.	Description.	Age.	Owner.
Bricklayer	Bay	3	Morrell Bros., Elphinstone
Broadarrow	Bay	4	F. T. Walker, Darriwell, *via* Bell
Broadcast	Brown	4	E. Rickerts, Walker street, Bundaberg
Cedarwood	Black	3	J. C. Schweikert, Yandilla
Gay Night	Brown	4	M. Robeck, Rockside, Gatton
Sir David	Bay	3	H. C. Gooding, Benowa, Southport
Vale Opera	Chestnut	3	L. T. Graham, Goomeri

PONY STALLIONS CERTIFICATED FOR YEAR 1933–34.

Name.	Description.	Age.	Owner.
Ding Dong	Bay	4	J. C. Mann, Pittsworth
Ebony	Black	4	E. Taylor, Fletcher
Eclipse	Taffy	4	M. J. Mullins, Goomburra
Guina	Chestnut	3	T. H. Welke, Kleinton
Little Mischief	Chestnut	3	R. Humphreys, Rosedale
Pento	Cream	4	A. Skyring, Kinbombi
Petite's Pride	Bay	4	A. O. Harm, Byee, Murgon
Sandy	Cream	4	J. Connors, Gundiah
Sir Pastel	Brown	3	D. R. Hutton, Cunningham
The Black Joke	Black	4	A. J. Salsbury, Duaringa
Tibby	Brown	4	H. Weigel, Hatton Vale
Tom Thumb	Chestnut	4	C. Donovan, Laidley
Young Guinea	Bay	3	H. H. Ehlrich, Douglas, *via* Goombungee

DRAUGHT STALLIONS CERTIFICATED FOR YEAR 1933–34.

Name.	Description.	Age.	Owner.
Banker	Bay	3	G. E. Bassingthwaite, Rosevale, Jandowae
Barney II.	Bay	4	W. Mow, Kurrumbul
Baron Favour	Bay	3	J. M. Newman, Caboolture
Baroona Musketeer	Chestnut	3	E. Mussing, Pomona
Bay Baronet	Bay	4	Mulholland Bros., Gympie
Beau Ideal	Bay	4	P. J. McCauley, Neurum
Belted Knight	Dark-bay	3	G. S. Miller, Upper Freestone
Ben	Bay	3	F. P. Alexander, Inverai, *via* Warra
Ben	Bay	3	V. Trott, Reid Creek, Gayndah
Ben Dale	Bay	3	R. E. McEwan, Cedar Creek, Pittsworth
Ben Hur	Black	3	R. C. Jefferies, Johnstown
Billy	Bay	3	H. Litherland, Beaudesert
Black Watch	Black	4	Fairymead Sugar Co., Bundaberg
Bob	Brown	4	A. Kunde, Kilcoy
Bold Boy	Bay	3	L. A. Armstrong, Rosewood
Bold Hero	Bay	3	G. Day, Grandchester
Boondandilla	Brown	4	C. Wright and Sons, Kindon, Goondiwindi
Bownce	Bay	3	W. H. Louttit, Windera
British Earl	Bay	3	P. G. Wilkie, Gayndah
Briton	Bay	4	R. Chandler, Forest Springs, Clifton
Captain	Bay	4	W. G. Rudd, Mudgeeraba
Captain	Brown	4	D. McCarroll, Murrumba
Captain Duke	Brown or black	3	F. Horne, Linville
Carlyle Prairie	Bay	3	T. W. Green, Jandowae
Chancellor	Bay	4	S. A. Plant, Trevanna, Cooyar
Charlie Boy	Bay	4	J. Wass, Rosewood
Clyde Prefect	Bay	3	J. S. Love, Townsville
Colonel	Bay	3	H. W. Zieball, Dalkeith, Mount Tyson
Crystal Boy	Bay	3	S. Webster, Kilcoy
Crystal Duke	Bay	3	J. Kennedy, Kumbia
Don Robin	Bay	3	W. F. Peters, North Maclagan
Double Top	Bay	Aged	C. J. Nielson, Yangan (Provisional)
Duke	Bay	4	A. Kahker, Gahan
Duke Dale	Brown	3	C. Tillack, Hatton Vale
Duke of Invermay	Bay	3	W. Richardson, Clifton
Duke of Sunnyside	Bay	4	W. F. Burge, Gomoran, Goombungee
Edgecombe Prince	Bay	3	J. W. Ritter, Mount Tyson
Farmer's Glory	Bay	3	F. Abraham, Lark Hill, *via* Walloon
Firedale	Bay	3	Fairymead Sugar Co., Bundaberg
Gindie Boy	Chestnut	4	G. L. Opperman, Ormeau
Gladfield	Black	3	P. W. Flynn, Redland, Clifton
Glen Dale	Bay	4	H. Truloff, Minden
Glenmore	Bay	4	F. P. Alexander, Inverai, *via* Warra
Heather Dale	Black	3	W. F. Whitney, Cowra
Hendon Bill	Brown	3	G. H. Clarke, Allora
Highland Boy	Bay	4	M. G. Topfer, Myury Villa, *via* Oakey
Highland Chief	Black	4	A. A. Treasure, Brigalow
Iron Duke	Grey	3	A. E. Missen, Clifton
Jondaryan Carlisle	Bay	3	H. J. Steinhardt, Marburg
Jondaryan McIntyre	Bay	3	J. Sprott, Ellenthorp
Jondaryan Wee Mac	Bay	3	W. B. Simpson, Hughenden
King Godfrey	Bay	4	J. W. Rush, Dulacca
Kingsford	Bay	Aged	W. P. Hyde, Nanango (Provisional)
King Wyllie	Chestnut	Aged	W. M. Hubbard, Chinchilla
Knight Abbit	Brown	4	P. G. Ruhle, Motley

DRAUGHT STALLIONS CERTIFICATED FOR YEAR 1933-34—*continued.*

Name.	Description.	Age.	Owner.
Lion	Bay	3	J. J. and D. W. Shine, Fernvale
Lion	Bay	4	A. Langton, Bunya Mountains, Dalby
Lochaber Lad	Bay	3	T. Laidler, Mundubbera
Lockyer Premier	Bay	3	C. Mahomet, Casino
Lord o' the Hills	Bay	4	E. Hindmarsh, Lyra, Stanthorpe
Lord Wallace	Bay	4	A. O. Harm, Byee
Lord Wheeler	Bay	3	C.Q.M.E. Co., Ltd., Lake's Creek
Major Wallace	Bay	4	Gross Bros., Campbell's Plains, Warwick
Monarch	Bay	4	J. C. Evans, Moola
Monarch	Brown	3	C. Head, Yangan
Newtown Baron	Bay	3	J. R. Anderson, Southbrook
Nobby's Pride	Bay	4	L. Ferguson, Nobby
Noble	Bay	3	J. W. Schultz, Coal Creek
Noble	Brown	3	R. G. Alexander, Inverai, *via* Warra
Orlato	Bay	4	C. Howe, Beebo
Patent	Brown	3	G. L. Opperman, Ormeau
Premier's Pride	Dark-brown	4	P. E. Muckert, Gueena, Murgon
Prince	Bay	4	R. Williams, Kingaroy
Punch	Black	4	G. H. Fowler, Pittsworth
Punch	Brown	3	O. Reinke, Rosewood
Retaliator	Bay	3	T. J. Brosnan, Killarney
Rising Son	Bay	4	T. Dingle, Drummer's Creek
Royal	Bay	4	F. H. Hahn, Coulson
Royal Blue	Blue-grey	4	W. P. O'Sullivan, Ascot, *via* Greenmount
Royal Chance	Dapple-bay	4	W. J. Prosser, Kulpi
Royal Dale	Bay	4	O. P. Kanofski, Amberley
Royal Jock II.	Bay	4	R. W. and O. Kleinschmidt, Woongoolba
Royal Prince II.	Bay	3	G. S. Mant, Brooweena
Royal Prince	Bay	3	W. G. Bedgood, Crow's Nest
Sailor	Bay	3	E. M. Tong, Boynewood
Sergeant's Orphan	Brown	4	A. Kubler, Boonah
Shepherd's Pride	Bay	4	G. E. Crane, Elbow Valley, Warwick
Sheppard Prince	Bay	6	S. T. Evans, Chinchilla (Provisional)
Sir Douglas	Bay	4	Honey and Braithwaite, Murgon
Special Mac	Bay	3	W. J. Borchert and Son, Murgon
Square Dale Yet	Bay	4	A. Jansen, Swanfels, Warwick
Star	Blue-roan	3	W. Johnston, Strathpine
St. Helen's Bruce Dale	Bay	3	C. B. Baxley, Dalby
St. Helen's Lauder Dale	Bay	3	O. E. Lock, Back Plains, Clifton
St. Helen's Piper	Bay	4	S. A. Porrett, Flinders
St. Helen's Rob Roy	Bay	4	M. Gould, Yarraman
Studleith Premier Lad	Bay	3	G. P. Walker, junr., Helidon
Talgai Refiner	Black	3	H. C. Sprott, Ellenthorp
Talgai Wallace	Brown	4	W. Profke, Glamorgan Vale
The Intent II.	Bay	4	M. Gould, Neumgna
The Rajah	Brown	4	Jas. Love, Townsville
The Tent	Black	3	J. Love, Townsville
Tony	Bay	3	R. Bryce, Wootha
Wallace	Bay	3	G. Stanfield, Proston
Wallace	Bay	5	J. Braithwaite, Chinchilla (Provisional)
War Dale	Bay	3	F. G. Turner, Inverell
Wilga King	Bay	3	F. W. Goodall, Milmerran
Warawingeth Dignity	Bay	4	A. F. Creswick, St. Helen's, Pittsworth
Worthy Carlisle	Bay	3	J. Lehmann, Coolana, Rosewood
Worthy Craig	Bay	4	Wilson and Janson, Yandina
Young Baron's Pride	Bay	4	A. Hammond, Swan Creek
Young Kingsford	Bay	3	Scott Bros., Toogoolawah

BLOOD STALLIONS CERTIFICATED FOR LIFE DURING THE YEAR 1933-34.

Algiers	Bay	6	J. M. Newman, Caboolture
Ambercot	Chestnut	Aged	J. O. Kyffin, Acland
Amberwee	Bay	6	C. Hansen, College street, Ascot
Ante-Up	Dark-bay	5	W. Rankin, Toowoomba
Ardbern	Bay	6	R. G. L. Boxsell, Taylor street, Toowoomba
Auburn King	Chestnut	6	W. Fevriegel, Bald Hills
Ayr Nut	Chestnut	Aged	M. Muller, Wowan
Banistar	Brown	6	H. G. Young, Mount Stanley
Bevallas	Bay	Aged	H. V. Webster, Glenview, Berajondo
Black Apple	Black	5	P. L. Murray, Gunalda
Boebridge	Chestnut	Aged	J. W. Royan, Isis Central Mill, Childers
Bonnement	Bay	Aged	J. H. S. Barnes, Canning Downs, Warwick
Canonbie	Chestnut	Aged	T. Bishop, Rocky Glen, Cooyar
Carnival	Black	Aged	C. A. Barnard, Duaringa
Clever Laddie	Bay	5	R. G. Talbot, Ripplebrook, St. Lawrence
Clyde Scholar	Brown	6	G. Wilson, Yangan
Coondarra	Bay	5	C. Wright and Sons, Kindon, Goondiwindi
Corban, imp.	Bay	Aged	J. F. Jennings, Greenmount
Corban II.	Bay	5	M. Cavanagh, Hawkwood
Craftdancer	Chestnut	Aged	B. C. McNairn, Peachey

BLOOD STALLIONS CERTIFICATED FOR LIFE DURING THE YEAR 1933-34—*continued.*

Name.	Description.	Age.	Owner.
Daplin	Brown	6	J. C. Stockden, Cinnabar
Dear Sir	Bay	6	H. Spencely, Winton
Deerborough	Chestnut	Aged	A. H. Maguire, Kialla, Greenmount
Devonus	Brown	5	J. B. Shannon, Tooloombah
Dick Syce	Bay	Aged	T. Laidler, Mundubbera
Disclaim	Chestnut	Aged	J. B. Shannon, Tooloombah
Don Devas	Bay	Aged	J. M. Kennedy and Co., Wigton, Wondai
Emrix	Brown	5	E. K. Rideout, Mount Larcom
Friction Gun	Grey	5	T. J. Tobin, Daylsford
Gold Fern	Chestnut	Aged	J. J. Johns, Yeerongpilly
Grand Alliance	Bay	Aged	W. J. Lloyd, Harrow, Cambooya
Grey Tie	Bay	Aged	Walloon Pastoral Co., Walloon
Hebrus	Chestnut	Aged	J. P. Rodgers, Redfield, Talwood
High Airs	Brown	5	C. Lawton, care of A. G. Anderson, Hendra
Highland Nectar	Black	Aged	T. H. Murray, Rockhampton
Hop On	Brown	Aged	J. Wade, Gundiah
Hopover	Chestnut	Aged	H. J. Hyne, Maryborough
Hycon	Bay	6	P. Martin, Nudgee road, Hendra
Jo Jo	Bay	Aged	J. W. Sutherland, Inglewood
Kenilworth Mac	Chestnut	5	R. J. Barry, Jandowae
King Adorn	Bay	5	W. H. Kirk, Mundubbera
Kingspear	Brown	Aged	L. W. Fuymer, Silverspur
Laddie	Bay	5	C. Brooker, Swanfels
Listowel	Chestnut	Aged	J. H. Walker, Oakey
Lord Assam	Bay or Brown	Aged	Estate of C. A. Munro, Silverspur
Lord Leebius	Chestnut	Aged	J. Hunter, Yarraman
Lord Paddington	Bay	Aged	F. Beckmann, Plainview
Luigi	Chestnut	Aged	W. Gunn, Kildonan, Goondiwindi
Mat Syce	Bay	6	M. Kavanagh, Hawkwood, Mundubbera
McIntyre	Brown	5	H. B. Wilson, Covea, *via* Tingoora
Mecca	Bay	5	F. J. Watts, Yangan
Midwick	Chestnut	Aged	Scott McLeod, Inglewood
Minbar	Brown	5	W. J. Hampson, Cloyne, Goomeri
Mintnut	Bay	6	S. S. Webb, Neil street, Toowoomba
Monsildale	Brown	6	J. M. Kennedy, Villiers street, New Farm
Mote	Chestnut	Aged	Leonard and Sons, Welltown, Goondiwindi
Mr. Patience	Bay	5	C.Q.M.E. Co., Lake's Creek
Noble Deed	Chestnut	5	A. Pfingst, Glen Vale, Warwick
Noel Soldat	Bay	5	D. C. Cameron, Le Geyt street, Windsor
Nubian	Black	6	B. R. Lawless, Windera
Oatshell	Chestnut	Aged	C. Martin, Kumbarilla
Ocean Force	Bay	5	M. A. Gargett, Sandgate
Olive Steel	Chestnut	Aged	J. F. O'Sullivan, Wallaville
Omaga	Black	Aged	J. B. Shannon, Tooloomba
Opal Dean	Chestnut	Aged	M. McKenzie, Mooroondan
Pat Doolan	Bay	Aged	F. Jurgs, Cecil Plains
Pershay	Bay	Aged	Mrs. Bernicke, Pilton
Policastro	Chestnut	Aged	J. W. McKenzie, Dingo
Polmania	Bay	5	J. Docherty, Caraki, New South Wales
Prince Seremond	Brown	Aged	R. Hill, Unumgar, New South Wales
Ramazan	Chestnut	Aged	J. N. Lane, Pomona
Red Robin	Chestnut	Aged	W. H. Thrupp, Roma
Royal Foote	Bay	5	D. A. Wormwell, Meandarra
Royal Heather	Brown	Aged	McKenzie Bros., Alton Downs
Roysterer, imp.	Brown	Aged	T. J. Turkington, Wattlebrae, Pilton
Shell Shock	Chestnut	Aged	A. M. Cadell, Limevale
Shoulder Arms	Bay	5	Mary E. McGhee, Berajondo
Star Arrow	Chestnut	Aged	J. D. Stirrat, Mount Larcom
Sun Eagle	Brown	6	P. Reynolds, Richmond, New South Wales
The Buzzard, imp.	Bay	Aged	J. G. McDougall, Lyndhurst, Warwick
Tiny Mack	Chestnut	Aged	J. H. Truce, Brooklands, Kingaroy
Trent Simon	Chestnut	5	A. Perrett, junr., Elgin Vale
Tressador	Chestnut	6	C. Blume, Hamilton
Unumgar	Brown	Aged	J. V. Carrigan, Toobeah
Wayland Debs	Brown	5	J. Shanahan, Jane street, Ascot
Wise Force	Bay	Aged	D. W. McDougall, Dulacca West

TROTTER STALLIONS CERTIFICATED FOR LIFE DURING THE YEAR 1933-34.

Belmont Prince	Bay	5	G. Klaasen, Scarborough
Burgy Bee	Bay	Aged	R. Crooks, Allora
Don Harum	Black	Aged	T. H. Crust, Esk
Dux Wilkes	Brown	Aged	A. Oelrichs, Mount Mee
Grand Opera	Bay	Aged	F. H. Pioch, Maryborough
Rex Delavan	Brown	Aged	R. Limberg, junr., Esk
Ribbon Bells	Dark-bay	5	F. Knecker, Bowen street, Annerley
Some Jewels	Brown	5	E. J. Wallin, Deception Bay
Woodhall	Bay	Aged	H. Wise, Kilcoy
Young Afghan	Brown	Aged	W. H. Lee, Nudgee

PONY STALLIONS CERTIFICATED FOR LIFE DURING THE YEAR 1933-34.

Name.	Description.	Age.	Owner.
All Black	Black	Aged	H. Klotz, Yandina
Auto Pay	Black	Aged	S. Russell, Chinchilla
Bennie	Chestnut	5	M. L. Horan, Inverlaw, Kingaroy
Billy Hughes	Chestnut	6	D. J. Wyllie, Canaga
Black Paddy	Black	Aged	D. P. McColm, Warwick
Blue Light	Bay	5	J. Russell, Lusitania street, East Ipswich
Comrade	Bay	Aged	F. L. Hampson, Cania
David	Grey	Aged	D. England, Gympie
Eclipse	Mouse	Aged	L. R. Martin, Kumbarilla
Faraam Mercury, imp.	Dapple-grey	Aged	J. M. Newman, Caboolture
Gold Fire	Chestnut	5	L. B. Evordell, Woodhill
Guinea	Chestnut	Aged	S. S. Webb, Neil street, Toowoomba
Japoon	Taffy	Aged	C.Q.M.E. Co., Lake's Creek
John Bull	Brown	5	H. G. Blair, junr., Harlin road, Ipswich
Little Dick	Taffy	Aged	O. W. Limberg, Esk
Little Don	Bay	6	C. Jose, New Moonta
Mac's Pride	Bay	5	S. H. Reynolds, Glasgow street, Toowoomba
Master Cupid	Black	5	J. Ryan, Stanthorpe
Mischief	Bay	Aged	W. Kruger, Jandowae
Mischief	Bay	Aged	A. Rae, Tirroan
Peter Pan	Chestnut-roan	5	C. M. Smith, Gatton
Play Boy	Black	5	J. Mullins, Mill Hill
Polo II.	Bay	5	F. G. Collins, Rosedale
Prince Michael	Taffy	Aged	T. R. Gordon, Kenilworth
Romulus	Light-chestnut	Aged	S. B. Trigger, Hopewell, Lakeside
Small Boy	Chestnut	Aged	R. McLean, Watalgan
Steele Rudd	Grey	Aged	A. G. A. Spencer, Glen View, *via* Yandina
The Hero	Bay	Aged	J. H. Atherton, Miva
Tim	Black	Aged	R. L. Boyd, Byrnestown
Tomboy	Brown	Aged	Mrs. E. T. Thompson, Calliope
Tom Thumb	Brown	Aged	E. H. Mann, Gooroolba
Uncle Mary	Dark-roan	Aged	L. Hughes, Childers
Victor Kelso	Brown	Aged	J. J. Tobin, Daylsford
Wee McKinney	Black	Aged	J. P. Ruhle, Motley, *via* Oakey
Young Wee McGregor	Black	Aged	W. J. Brazier, Jandowae

DRAUGHT STALLIONS CERTIFICATED FOR LIFE DURING THE YEAR 1933-34.

Name.	Description.	Age.	Owner.
Admiration	Bay	Aged	E. W. Genrich, East Cooyar
Again Champion	Black	Aged	J. Stenzel, Carney's Creek, Boonah
Ardlaw's Heir	Bay or brown	Aged	J. Sprott, Ellenthorp
Ballora	Bay	Aged	A. F. Hale, Eidsvold
Baronet	Brown	Aged	P. A. Todd, Biggenden
Baron Boy	Bay	Aged	G. H. Smith, Amamoor
Baron Bruce	Bay	5	S. Brown, Howard
Baron Sheriff	Bay	Aged	A. C. V. Bligh, Brookstead
Baron Wyllie	Bay	5	A. J. Edwards, Spring Valley, Kingaroy
Baron's Pride	Bay	Aged	C. B. Euler, Goomeri
Ben Alder	Bay	Aged	E. P. Campbell, Woombah, Mount Perry Line
Black Prince	Black	6	D. Stark, Anduramba
Bold Bill	Bay	5	J. Bowling, Coolabunia, Kingaroy
Bold Knight	Black	5	Fairymead Sugar Co., Bundaberg
Boree Fame	Brown	Aged	A. M. Cadell, Limevale
British Joy	Brown	Aged	J. P. Wormwell, Greenbank, Tara Line
Bruce	Bay or brown	Aged	Jas. Goodman, Stanwell
Bull	Bay	Aged	C. A. Munro Estate, Silver Spur
Captain Campbell	Bay	6	R. W. Henney, Symsdale, Bell
Chieftain	Grey	5	J. D. Stirrat, Mount Larcom
Chummy	Grey	5	J. McAulay, Hive Camp, Goomeri
Clyde	Bay	Aged	H. Rattey, Jandowae
Clyde Shepherd	Bay	Aged	J. V. Willis, Cooby Creek, Meringandan
Colonel of Kilbirnie	Bay	5	McFarlane Bros., Radford
Craigie Willie	Bay	Aged	A. Adie, Childers
Crystal Hope	Black	5	Galloway Plains Pastoral Co., Calliope
Crystal MacBride	Bay	5	H. A. Free, Ascot, *via* Greenmount
Crystal Spot	Bay	5	T. Clark, Nagoorin
Crystal Tom	Chestnut	Aged	J. F. Hubert, Mungar Junction
Crystale Vale	Chestnut	Aged	M. Betts, Guy street, Warwick
Darnley	Bay	Aged	J. L. Richards
Dew of Whitecliff	Grey	6	C. Anger, Duaringa
Donald	Grey	Aged	A. Ziebarth, Biloela
Duke	Bay	Aged	H. and F. Mason, Gurulmundi
Duke of Huntleigh	Chestnut	Aged	C. Ballin, Tallegalla
Dundonald III.	Black	Aged	Estate of J. Wason, Kilkivan
Endeavour	Bay	Aged	J. F. Hegarty, Silverwood, Brookstead
General Intent	Bay	5	J. T. Wade, Boompa
General Prince	Bay	Aged	H. Newton, Square Top, Bell Line
Gindie Majesty	Chestnut	Aged	H. G. Zipf, Norwell
Glencoe	Brown	Aged	W. Johnston, Kerry
Glen Dale	Black	6	H. Werherspoon, Glenmore, Kulpi
Glenelg	Bay	6	J. Wade, Gundiah
Glengarry	Bay	5	Estate of late P. C. Anderson, Wondai
Glen King	Bay	6	W. Chard, Glengallen

DRAUGHT STALLIONS CERTIFICATED FOR LIFE DURING THE YEAR 1933-34—*continued.*

Name.	Description.	Age.	Owner.
Glenmore	Bay	Aged	E. J. Cross, Berajondo
Glenroy	Black	Aged	L. Dascombe, Newland, Haden
Glen Roy	Bay	Aged	C. Kiepe, Stockyard Creek, Helidon
Glory	Brown	Aged	N. Thornton, Rocky Creek, Milmerran
Hendon Hope	Bay	Aged	D. A. Proctor, Byrnestown
Highland Chief	Bay	Aged	J. D. Learmonth, Hill View, Pittsworth
Hillview Jock	Black	6	R. J. O'Brien, Pullen Vale
Hudson	Bay	6	W. J. Agnew, Elphinstone
Johnie Walker	Bay	Aged	M. Jensen, South Kolan
King Dale	Brown	5	E. C. H. Zillman, Hatton Vale, Laidley
King Tom	Bay	5	A. Pfingst, Glen Vale, Warwick
Kitchner	Brown	5	T. J. Coleman, Toogoolawah
Lord Robert	Bay	Aged	Turner and Munro, Wyaga, Goondiwindi
Loyal George	Bay	Aged	J. E. Lysaght, Maryvale
Majestic	Bay	Aged	S. B. Trigger, Hopewell, Lakeside
Major	Bay	6	St. Vincent's Orphanage, Nudgee
Major	Grey	Aged	A. E. Pechey, Pechey
Major	Bay	5	J. Sinclair, Glencoe, Eidsvold
Major Dale	Bay	5	D. J. Crowley, Crowley Vale
Major Dale	Bay	5	D. W. McDougall, Dulacca West, Jackson
McGregor	Bay	5	E. Frain, Miles
Nelson	Bay	Aged	A. J. Telford, Cambooya
Noble Prince	Dark-bay ..	6	R. Stark, Wondai
Pilot	Bay	Aged	J. H. Rogash, Goomeri
Ploughboy	Bay	Aged	W. E. Cockerill and Son, Boyne River, *via* Tingoora
Premier	Bay	Aged	A. F. Kerkow, Byee
Pride of Glen Cairn ..	Bay	Aged	E. G. Henderson, Sexton
Pride of the Mount ..	Bay or brown ..	Aged	S. G. Wagner, Kilcoy
Prince	Bay	Aged	D. Hinchcliffe, Yaamba
Prince	Dark-bay ..	Aged	Hunter Bros., Mount View, Cinnabar
Prince	Bay	Aged	W Stead, Cecil Plains
Prince Arthur	Bay	Aged	F. Prior, Wolca, Mount Perry Line
Prince Carlyle	Bay	Aged	A. Sippel, Redgate, Murgon
Prince Charles	Chestnut ..	Aged	J. Coss, Brigalow
Prince Dale	Brown	5	F. C. Manz, Lockrose
Prince Jelbyn	Bay	6	Walsh Bros., Beaudesert
Prince of Glenore ..	Brown	5	Ducat Bros., Tweed Heads
Prince of Springview ..	Bay	5	M. Dingwall, Gunnewin
Proston Lad	Bay	6	J. Bonsfield, care of J. Mitchell, Proston
Punch	Bay	Aged	H. Hill, Flaggy Rock
Punch	Brown	Aged	Margaret McGrath, Nankin Junction
Punch	Bay	6	P. Hunt, Warra
Renown	Bay	Aged	R. V. Breydon, Haden
Rising Heir	Bay	Aged	T. Dingle, Drummer's Creek
Robin Adair	Bay	Aged	M. C. Bishop, Glengowrie, Maidenwell
Royal Prince	Black	Aged	G. H. A. Koeler, Yamsion
Royal Robert	Bay	6	W. Donald, Booyal
Royal Scot	Bay	Aged	R. Humphreys, Rosedale
Ruben	Bay	5	E. I. Wallace, Fairview, Biloela
Scottish Hero	Roan	5	D. C. McWilliam, Alfalfa, Leyburn
Sir Garnet	Brown	Aged	J. H. Atherton, Miva
Sir William	Bay	Aged	B. Oberhardt, Pittsworth
Spark	Brown	5	R. M. Bell, Eskdale
Speewarmick	Bay	Aged	M. Muirhead, Pittsworth
Springmead Bright Laddie	Brown	Aged	W. A. Embrey, Tallegalla
Springside Trooper ..	Brown	Aged	R. E. Clay and Sons, Samson Vale
Talgai Leader	Dark-bay or brown	6	J. Sprott, junr., Ellenthorp
Talgai Pride	Bay	5	H. R. McIlveen, Giddi Giddi, Gooray
Tamar Mail Boy ..	Bay	5	A. Kubler, Boonah
Tiger	Bay	5	J. Tobin, Currajong
Vampire	Bay	Aged	F. A. Schelbach, Harrisville
Victory	Bay	Aged	H. E. M. Leggett, Gayndah
Wallace Lad	Bay	5	C. E. Morgan, Windera, *via* Murgon
Worthy Mac	Brown	Aged	Jondaryan Estate Co. of Australia, Ltd., Jondaryan
Wylie's Knight	Bay	Aged	E. Reinbott, Booie
Young Grafter	Bay	Aged	M. F. Kirstenfeldt, Nutgrove, Cooyar Line
Young Prospector ..	Brown	5	L. A. Teske, Mount Beppo

List of stallions in respect of which Certificates of Registration were refused on account of either unsoundness or lack of type and/or conformation during the year 1933-1934. These horses are prohibited from service, either public or private.

BLOOD STALLIONS REJECTED DURING THE YEAR 1933-34.

Abbey Boy	Bay	4	H. O. Mischke, Veradilla
Alstar	Bay	Aged	W. J. Davey and Sons, Mimosa, Raglan
Araby	Light-bay ..	6	Messrs. Kessell and Worthington, Bororen
Barmoor	Brown	5	J. D. Lawless, Goomally, Duaringa
Black Spring	Brown	Aged	A. L. McDonald, Yaamba
Blue Monk	Grey	Aged	F. F. Doyle, Nogo River Junction, Ceratodus
Flying Fox	Bay	6	A. Kundy, Kilcoy
Gay Eiffle	Bay	4	W. Caldwell, Highlands, Bell

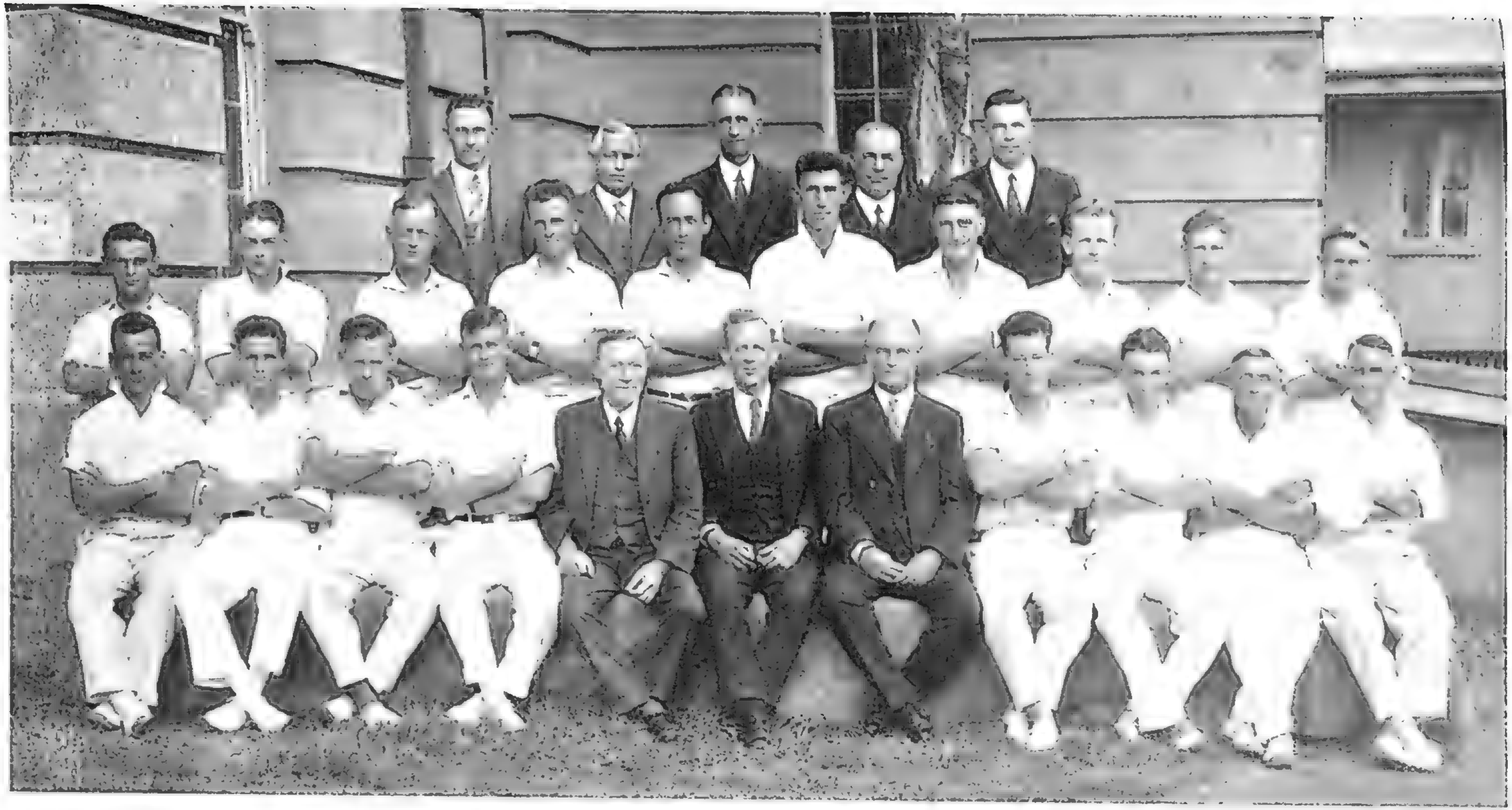


PLATE 169.—OFFICE BEARERS AND MEMBERS OF DEPARTMENT OF AGRICULTURE AND STOCK CRICKET TEAMS.

First Grade (Runners Up) and 3C Grade (Premiers), Q.C.A. (Warehouse Division), 1933-34.

Back Row.—E. Keefer, S. S. Hooper, R. Short, J. P. Orr, H. Barnes.

Second Row.—S. Davis, E. Burns, F. Bell, A. Kerr, H. S. Hunter, M. Muller, C. N. Morgan, W. E. Hamley, R. Pritchard, J. C. Maunder.

Front Row.—E. Taylor, C. Peel, C. J. McKeon, S. Pegg, E. Graham, (Under Secretary), Hon. F. W. Bulcock, M.L.A. (Minister for Agriculture and Stock), R. Wilson (Assistant Under Secretary), R. Taylor, T. McKnight, W. Palmer, S. Burchill.

BLOOD STALLIONS REJECTED DURING THE YEAR 1933-34—*continued.*

Name.	Description.	Age.	Owner.
Gold Arm	Bay	6	P. Kerwick, Edward street, Dutton Park
Gold Mat	Chestnut	6	D. H. Proctor, Glen Valley, Byrnestown
Handsome Lad	Black	Aged	J. H. Blair, Harlin road, Ipswich
Hyman	Chestnut	Aged	H. Goodman, Stanwell
Jim Boy	Chestnut	Aged	C. S. Curtis, Tanby, Tungamull
Jimmy Jocks	Bay	Aged	W. Cadwallader, Swanson Park, Tungamull
Kelso	Brown	Aged	J. Ross, Eukey
Ladysal	Bay	Aged	H. Hancock, Killarney
Lancer	Bay	4	H. A. Burgess, Miriam Vale
Lord Ascot	Brown	Aged	J. Ward, Harrisville
Matterhorn	Chestnut	Aged	E. P. Itzstein, Hyde Park, Gooroolba
Mintoi	Bay	4	S. Schneider, Boonah
Monty	Chestnut	Aged	W. J. Park, Bli Bli P.O., *via* Nambour
My Gun	Black	4	C. O'Brien, Cabbage Tree, Ipswich
Narell	Chestnut	4	M. Coonan, Pittsworth
North Kerman	Bay	3	A. J. Lubke, Glamorganvale
Painter Russe	Bay	Aged	Mrs. Breydon, Haden
Persse's Promise	Chestnut	5	P. Ryan, Viewland, Gatton
Peter Pan	Bay	3	A. A. Young, Bristol Vale, Kinka
Peter the Silent	Chestnut	3	W. Pholi, Coraki, New South Wales
Pi Laddie	Bay	Aged	J. H. Furney, Dingo
Robin Hood	Bay	4	A. A. Treasure, Brigalow
Rosselah	Bay	Aged	Mrs. C. L. Davey, Roundstone, Baralaba
Sycebius	Brown	Aged	C. W. Mills, Nerang
Serefugle	Chestnut	Aged	J. P. Wormwell, Greenbank, Kupunn
Syce Knight	Chestnut	Aged	W. Grieve, Brookstead
Tom Turpine	Chestnut	5	F. M. Postich, River road, Warra
Unnamed	Chestnut	Aged	A. G. Lawrie, Evergreen, Westwood
Unnamed	Brown	4	J. W. Irwin, Redcliffe, Baralaba
Unnamed	Bay	Aged	A. Dunlop, Esk
Unnamed	Brown	3	A. W. Lord, Mount Stanley, Linville
Viceroy	Chestnut	6	H. G. F. Schneider, Mountain View, St. Lawrence
Wee General	Brown or black	Aged	J. Nolan, Baralaba
Welcome	Brown	Aged	R. Gross, Raglan
Winallan	Chestnut	4	D. M. Hay, Barmundu, Gladstone

TROTTERS REJECTED DURING THE YEAR 1933-34.

Comodore	Bay	4	J. W. Weedon, Biddeston
Prince Rapid	Bay or Brown	Aged	E. P. Macmillan, The Grange, Silkstone
Sheik	Chestnut	Aged	W. Gonchee, Esk
Steel Raven	Grey	5	R. A. Bowden, Pittsworth

PONIES REJECTED DURING THE YEAR 1933-34.

Joey	Black	4	D. Marschke, Bright View, Lowood
The Badger	Brown	5	W. J. Robinson, Esk
Unnamed	Brown	5	S. Dagg, Killarney
Unnamed	Brown	Aged	W. D. Draper, Duaringa
Windy	Bay	4	L. Lindenmayer, Milmerran

DRAUGHTS REJECTED DURING THE YEAR 1933-34.

Abbott	Brown	Aged	J. Barbour, Glen Ken, *via* Esk.
Ball	Bay	6	P. J. Maynes, Forest Park, Warwick
Bally	Bay	Aged	H. Williams, The Glen, Kingaroy
Barney	Bay	Aged	B. C. Cross, Drayton Park, Inglewood
Baron	Bay	6	G. W. Morgan, Childers
Baron Duke	Bay	Aged	A. L. Parkinson, Upper Koondaii, Bell
Baron Prince	Bay	4	Inglewood
Bellevue Harry	Bay	Aged	T. W. Caldicott, junr., Bellevue, Yandilla
Blaze	Brown	Aged	Dippelsman Bros., Allan, *via* Warwick
Blaze	Black	Aged	W. Christenson, Pacific View, Bororen
Blossom's Son	Brown	Aged	J. A. Kelly, Mount Crosby
Blue Speck	Grey	4	J. Childs, Bouldercombe
Bluff Wylie	Bay	3	M. Carlson, Lanefield
Bob	Brown	Aged	F. Maurer, Darra
Bounce	Bay	Aged	J. Peters, Esk
Boxer	Bay	Aged	D. W. Nolan, Roslyn Orchard, Burrum
Braw Laddie	Bay	Aged	D. M. Nielson, Gin Gin
British Lion	Bay	Aged	J. Mullins, Mill Hill
Bruce	Chestnut	5	W. R. Gordon, Gayndah
Captain	Bay	6	W. Draper, Duaringa
Captain Connor	Chestnut	3	Pomona
Charlie	Brown	6	W. Webber, Glen Eagle
Charlie	Bay	4	J. Ryan, Clifton
Cheeky	Bay	Aged	J. D. Bond, Wheatlands, Wondai
Chris	Bay	6	N. P. Dahl, and Sons, Cedars, Bororen
Craig Dale	Bay	6	T. Palmer, Greenmount
Crystal Clyde	Bay	4	C. J. Bradley, Quebec, Mundubbera

DRAUGHTS REJECTED DURING THE YEAR 1933-34—*continued.*

Name.	Description.	Age.	Owner.
Crystal Hero	Bay	4	J. D. Huston
Damsel's Star	Brown	Aged	C. J. Stack, Inglewood
Donald's Son	Brown	Aged	W. E. Webster, Sarum, Kingaroy
Don Pearce	Bay	3	C. J. Clarke, Royal Oak, Tiaro
Drummer	Brown	Aged	H. A. Buchbach, Yandaran
Duke	Brown	3	F. P. Stark, Wondai
Duke	Brown	Aged	J. W. Weedon, Giddeston, Oakey
Duke	Bay	4	M. J. Camac, Theodore
Duke of Argyle	Bay	Aged	G. Nicholls, Pratten
Dunure Dale	Bay or brown	Aged	C. A. Pitt, Boyland Station, Beaudesert
Farmer	Brown	6	F. Waelmer, Newington, *via* Jondaryan
General	Bay or brown	Aged	C. F. W. Beckmann, Mulgowie
General Touch	Bay	6	J. A. Collett, Pomona
Glancer II.	Brown	5	A. Krueger, Kalbar
Gret Stain	Grey	3	A. E. Rankin, Binbi, Duaringa
Grey Gown	Grey	Aged	J. O'Rourke, Greenmount
Hero	Bay	Aged	J. A. Carlson, Nikenbah
Ideal Ron	Bay	6	L. Wedemeyer, Eidsvold
Jack Wallace	Brown	Aged	A. H. Lowe, Boller, *via* Kandanga
Jem	Chestnut	6	F. J. Stone, Currajong Creek, *via* Tirroan
Jim	Bay	6	A. H. and E. M. Kelland, Wowan
Joe	Bay	Aged	R. Bushnell, Ideraway
John	Bay	4	J. D. Wilson, Calliope Station, Calliope
Leo	Bay	..	W. Ford, Biggenden
Major	Chestnut	3	H. Nothdurft, Claremont, Oakey
Major	Bay	5	H. F. Blank, Kilcoy
Mark	Bay	..	J. Wood, Mount Chalmers, Tungamull
Monty of Glen Ian	Brown	4	S. H. Gralow, Theodore
Moor's Luck	Bay	4	F. M. Postich, River road, Warra
Mount Pleasant Wallace	Black	6	W. B. McLaughlin, Harrisville
Noble	Bay	6	G. Elliott, Sliepner Junction
Noble	Bay	Aged	Inglewood, South Downs
Nugget	Chestnut	Aged	E. W. Hill, Hillview, Beaudesert
Ploughby	Bay or brown	Aged	R. A. Filton, Kerry
Pride	Bay	Aged	J. J. Kessler, Cambooya
Pride	Brown	3	F. Niethe, Mundubbera
Pride of Glenmore	Black	Aged	W. C. Lund, Penshurst, Grandchester
Prince	Black	Aged	Archer Bros., Gracemere
Prince	Bay	..	R. J. Jenkins, Miva
Prince Chamberlain	Bay	Aged	C. F. Schmid, Pialba
Prince Tom	Bay	4	P. F. Schuh, Mount Perry
Punch	Bay	..	J. McLellan, Baralaba
Punch	Brown	5	B. Bradley, Ballandean
Punch	Bay	5	A. J. F. Gerchoo, Boonah
Richmond	Brown	Aged	A. Hanson, Amberley
Robin	Bay	Aged	J. Reif, Boonah
Robin Hood	Bay or brown	6	L. J. Clegg, Pratten
Rover	Bay	5	A. J. Specht, Tahara, Wellcamp
Royal Rolls Royce	Brown	Aged	J. Hardy, Eukey
Scottish Hope	Bay	3	A. C. Lawson, Deborah, *via* Netherby
Sir Oliver	Bay	Aged	H. Hiscock, Lochiel, Mulgeldie
Sir McIvar	Bay	5	F. B. Cory, Vermont, Warwick
Skipper	Bay	..	O. G. Draper, Tabooba
Spec	Bay	Aged	J. Russell, Chinchilla
Special	Brown	Aged	E. Cooper, Pratten
The Victor	Bay	5	K. Carew and W. E. Ivear, Kingaroy
Tiger	Brown	Aged	J. Muir, Blackbutt
Toby	Bay	6	Kerr Bros., Warra
Tommy Burns II.	Bay	Aged	J. H. Elsebach, Gayndah
Torsdale	Bay	Aged	J. S. Fovold, Barmundu
Trooper	Bay	6	M. E. Young, Kooinga
Trooper Dale	Roan	5	W. E. Sauer, Gayndah
Uncle	Brown	6	V. Osborne, Cobba-da-mana
Unnamed	Bay	5	—. Doran, Maryborough
Unnamed	Bay	Aged	—. Birch, Murgon
Unnamed	Bay	4	P. S. Connor, Stanwell
Unnamed	Bay	3	J. B. Pennell, Kalbar
Unnamed	Brown	5	G. Launder, Toogoolawah
Valley's Pride	Bay	5	J. Batley, Charlwood, *via* Kalbar
Wallace	Bay	6	C. Emery, Fairview, Bororen
Wallace Monk	Bay	Aged	H. J. Stokes, Thornton, Laidley
Warroo	Brown	5	G. F. Goodrich, Warroo, *via* Inglewood
Young Barron	Bay	4	W. C. Weeks, Boonnenne, Kingaroy
Young Jim II.	Bay	Aged	E. Anderson, Gympie
Young Rich and Rare	Bay	Aged	A. A. Watts, Yelarbon
Young Southgate Carbineer	Chestnut	Aged	R. Bishop, Moore
Ziff	Bay	Aged	J. W. Watson, Gympie

AGRICULTURE ON THE AIR.

Radio Lectures on Rural Subjects.

Arrangements have been completed with the Australian Broadcasting Commission for the regular delivery of further radio lectures from Station 4QG, Brisbane, by officers of the Department of Agriculture and Stock.

On Tuesdays and Thursdays of each week, as from the 3rd July, 1934, a fifteen minutes' talk, commencing at 7.15 p.m., will be given on subjects of especial interest to farmers.

Following is the list of lectures for July, August, and September, 1934:—

SCHEDULE OF LECTURES.

BY OFFICERS OF THE DEPARTMENT OF AGRICULTURE AND STOCK, RADIO STATION 4QG, BRISBANE (AUSTRALIAN BROADCASTING COMMISSION).

Tuesday, 3rd July, 1934—"Results of Disease Resistance Trials with Cane Varieties." By A. F. Bell, Sugar Pathologist.

Thursday, 5th July, 1934—"Intensive Cane Cultivation and Costs of Production." By Dr. H. W. Kerr, Director, Bureau of Sugar Experiment Stations.

Tuesday, 10th July, 1934—"Preparing Pigs for Show." By L. A. Downey, Instructor in Pig Raising.

Thursday, 12th July, 1934—"The Principles and Practice of Pig Feeding. By L. A. Downey, Instructor in Pig Raising.

Tuesday, 17th July, 1934—"Plants Poisonous to Stock." By C. T. White, Government Botanist.

Thursday, 19th July, 1934—"Plants Poisonous to Stock." By C. T. White, Government Botanist.

Tuesday, 24th July, 1934—"A Ramble in Rural England and its Lessons." By J. F. F. Reid, Editor of Publications.

Thursday, 26th July, 1934—"An Excursion to Scotland—Livestock Studies." By J. F. F. Reid, Editor of Publications.

Tuesday, 31st July, 1934—"Queensland—A Fruitful Country." By J. F. F. Reid, Editor of Publications.

Thursday, 2nd August, 1934—"The Story of Butter and Cheese throughout the Ages." By O. St. J. Kent, B.Sc., Analyst.

Tuesday, 7th August, 1934—"The Packing and Preparation of Tomatoes for Market." By J. H. Gregory, Packing Instructor.

Thursday, 9th August, 1934—"The Avocado in Queensland and Elsewhere." By H. Barnes, Director of Fruit Culture.

Tuesday, 14th August, 1934—"Packing Shed Hygiene." By J. H. Gregory, Packing Instructor.

Thursday, 16th August, 1934—"The Importance of Citrus Bud Selection." By H. Barnes, Director of Fruit Culture.

Tuesday, 21st August, 1934—"Papaw Cultivation." By H. Barnes, Director of Fruit Culture.

Thursday, 23rd August, 1934—"The Pasteurisation of Milk and its Products." By O. St. J. Kent, B.Sc., Analyst.

Tuesday, 28th August, 1934—"Vitamins in Dairy Products." By O. St. J. Kent, B.Sc., Analyst.

Thursday, 30th August, 1934—"Factors Influencing the Amount of Fat in Milk." By O. St. J. Kent, B.Sc., Analyst.

Tuesday, 4th September, 1934—"Seasonal Farm Crops," Part I. By C. J. McKeon, Instructor in Agriculture.

Thursday, 6th September, 1934—"Seasonal Farm Crops," Part II. By C. J. McKeon, Instructor in Agriculture.

Tuesday, 11th September, 1934—"Seasonal Farm Crops," Part III. By C. J. McKeon, Instructor in Agriculture.

Thursday, 13th September, 1934—"The Tobacco Industry Protection Act of 1933." By H. S. Hunter.

Tuesday, 18th September, 1934—"Some Requirements of Plant Growth." By E. H. Gurney, Agricultural Chemist.

Thursday, 20th September, 1934—"Fertilizers and Manures." By E. H. Gurney, Agricultural Chemist.

Tuesday, 25th September, 1934—"Nutritive Value of Pasture." By E. H. Gurney, Agricultural Chemist.

Thursday, 27th September, 1934—"Mineral Ingredients in Stock Foods." By E. H. Gurney, Agricultural Chemist.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Australian Illawarra Shorthorn Society and the Jersey Cattle Society, production charts for which were compiled during the month of April, 1934 (273 days period unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Kilbirnie Ethel 3rd	Macfarlane Bros., Radford	15,733·05	715·677	Mowbray of Darbalara
Diana 17th of Kelston	A. Frank, Boonah	15,950·2	687·803	First Warrior of the Cedars
Kilbirnie Viola 1st	Macfarlane Bros., Radford	13,252·4	561·656	Mowbray of Darbalara
Nancy 6th of the Retreat	D. Gierke and Sons, Helidon	12,741·17	557·457	Togo of Whiteoak
Rowdy III. (268 days)	G. Gwynne, Umbiram	11,088·6	484·87	Exchange of Balmoral
Trevor Hill Blossom	G. Gwynne, Umbiram	8,486·91	395·383	Prince of Braemar
Daisy II. of Trevor Hill	C. O'Sullivan, Greenmount	9,334·37	376·036	Prince of Braemar
SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.				
Fancy 4th of Blacklands (270 days)	A. M. Johnson, Gracemere	8,617·94	361·143	Governor of Blacklands
Phyllis 4th of Springdale	D. Gierke and Sons, Helidon	10,810·06	361 83	Lovely's Commodore of Burradale
JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.				
Trevor Hill Princess 2nd	G. Gwynne, Umbiram	11,614·8	449·270	Prince of Braemar
Miss Royal 2nd of Blacklands (268 days)	A. M. Johnson, Gracemere	8,502·05	369·305	Governor of Blacklands
Handsome 13th of Rosenthal	S. Mitchell, Warwick	8,369·5	316·304	Dividend
SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.				
Lovely of Trevor Hill	G. Gwynne, Umbiram	9,122·5	406·886	Illawarra II. of Mayfield
Ethel 5th of Kilbirnie	Macfarlane Bros., Radford	8,814·7	378·775	Mowbray 2nd of Kilbirnie
Jean 12th of Blacklands	A. Pickels, Wondai	8,000·3	327·301	Fussy's Monarch of Hillview

JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.				
Kingsdale Tot 4th	A. A. King, Mooloolah	7,995·7	370·044	Diamond Boy of Burradale
Rose 7th of Oakvilla	H. Marquardt, Wondai	9,937·23	365·687	Champion's Monarch of Oakvilla
Charm II. of Brundah	J. A. Heading, Cloyna	9,737·83	341·332	Osiris of Greyleigh
Penrhos Jess	A. Sandilands, Wildash	6,310·0	290·209	Bonnie Charmer of Coral Brae
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.				
College Stately	Queensland Agricultural High School and College, Gatton	8,908·01	435·766	Premier of Hillview
Kilbirnie Bella 16th	Macfarlane Bros., Radford	8,482·5	367·501	Kilbirnie Kenilworth
Woodlyn Midget Mavis (269 days)	J. L. Lyndon, Worongary	8,851·6	355·315	Spanker of Glenrock
Lady May 2nd of Blacklands (266 days)	A. M. Johnson, Gracemere	9,619·02	333·671	Hugo of Blacklands
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.				
Rosenthal Trixie 15th	F. G. Lamkin, Kaimkillenbun	9,056·97	371·917	Rosenthal Handsome's Boy
College Granny 3rd	Queensland Agricultural High School and College, Gatton	8,164·68	346·273	Fussy's Kitchener
JERSEY.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Pineview Jewel	J. Hunter and Sons, Borallon	8,403·81	549·913	Oxford Buttercup Noble
Kelvinside Lady Marguerite	J. R. Williams, Glencliff	7,903·2	379·704	Noble Clarence of Kelvinside
Trinity Lady Clare (272 days)	J. Sinnamon, Moggill	7,358·19	369·683	Trinity Governor
SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.				
Ruth of Ipsley	J. A. Rudd, Yeerongpilly	7,358·75	430·916	Rheubin of Ipsley
SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.				
Trecarne Rosella 4th	T. A. Petherick, Lockyer	9,628·06	568·249	Trinity Officer
Lottie of Calton	J. Collins, Tingoora	11,195·33	540·48	Prince Clair of Calton
JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.				
Oxford Sister	M. J. Dunn, Laidley	6,386·23	310·891	Oxford Silvius
Glenmah Victor's Edna	F. A. Maher, Moggill	5,705·05	306·705	Retford Victor's Noble
Oxford Silver	M. J. Dunn, Laidley	4,851·75	270·061	Oxford Silvius
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.				
Oxford Joyful Maid	E. Burton and Sons, Wanora	7,282·98	433·938	Trinity Ambassador
Moya's Pride of Newhills	J. Nicol Robinson, Maleny	5,636·65	352·447	President of Brooklodge
Trinity Cremorne	J. Sinnamon, Moggill	4,348·22	241·669	Trinity Cromwell

Answers to Correspondents.

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. Cyril T. White, F.L.S.

Rattlepod. *(Crotalaria acicularis)* Glycine Pea. Tick Trefoil.

J.W.H. (Caboolture)—

We can find no records of the properties of *Crotalaria acicularis*. It is a common weed in the Philippines and the East Indies, but in these countries stock do not play an important part and records of plants poisonous to them are few and far between. However, several species of *Crotalaria* have been definitely proved by feeding tests, both in Australia and abroad, to be poisonous to stock, and under the circumstances it is as well to regard the plant with suspicion and to prefer its room to its company. In the East several species of *Crotalaria* are grown as green manure, and they are excellent for the purpose. Most of them are more poisonous in seed than at any other time, so if the plant is in cultivation, and it is at all practicable, at the present time it would be a good idea to plough it in.

The creeping or twining legume is *Glycine tabacina*. This is a very common legume in the average native mixed pasture in coastal Queensland, and should be quite an important constituent. We have not heard a common name applied to it, and generally simply refer to it as the Glycine Pea.

The more bushy, upright plant is *Desmodium polycarpum*, a species of Tick Trefoil. Like most of the genus it should be quite good fodder, especially in rather wet, low-lying situations where this particular species is often found. The genus is a very large one, some of the members being small creeping plants, others of a more upright shrubby growth as in the present case. The name Tick Trefoil arises from the fact that the pods break up into a number of pieces, each bearing a number of seeds. These attach themselves to the clothing, the hairs of animals, &c., and in this way the plant is spread from one place to another.

Galvanised Burr.

INQUIRER (Brisbane)—

So far as we have observed the Galvanised Burr starts seeding at a very early age and when only a few inches high. It is rather hard to tell when the seed is ripe, but generally speaking it is ripe when the spiny burrs are fairly hard. If the seed germinates with the spring rains somewhere about September, the seed is probably ripe towards the end of November or early part of December. About January the plant is one mass of ripe seeds and continues in this state right through the winter until the following spring. Regarding the grub that is eating the burr, we advise your sending a sample of it to Mr. R. Veitch, Chief Entomologist, Department of Agriculture and Stock, Brisbane. As you may have seen by the papers, the Minister for Agriculture and Stock, the Hon. Frank W. Bulcock, is very keenly interested in pests of Galvanised Burr and some other weeds.

Rattlepod; Cluster Clover.

R.H. (Pomona)—

(1) With the yellow flower—*Crotalaria incana*, a species of Rattlepod. The Crotalarias or Rattlepods are dangerous plants, and several of them both in Australia and abroad have been proved poisonous to stock. No feeding tests have been carried out with the particular one you send, but so far as we have observed stock rather avoid it. It is sometimes called Native Lucerne, but this name it not to be encouraged as it more correctly belongs to other plants which are quite good fodders.

(2) With small clusters of dark-pink flowers—*Trifolium glomeratum*, the Cluster Clover, an animal clover that comes up mostly in the autumn months, lasts through the winter, and dies out on the approach of the warm weather. Your specimen is rather unseasonable. It is quite a good fodder and is occasionally sown, though most frequently it comes up of its own accord on the edges of cultivations and similar places.

Bella Sombra Trees.

J.C.J.H. (Strathpine)—

The sample represents the Phytolacca or Bella Sombra tree (*Phytolacca dioica*), a very quick-growing tree. Sometimes it is planted for shade and green fodder for stock. Chemical analysis shows the leaves to have quite a high fodder value. In the days of ostrich farming in South Africa the tree was said to have been planted quite frequently as a fodder for ostriches. As regards the berries, we have seen fowls eat large quantities of them, particularly the dried ones under the trees, without any ill effects following. When the berries fall from the trees they are generally dried and shrivelled, and in such a form have rather a dry, sweetish taste something like currants or raisins.

Red Natal Grass.

J.S.P. (Nanango)—

The specimen is *Rhynchelytrum roseum,* Red Natal grass. This grass was imported into Queensland many years ago as a fodder, though its use in this respect seems to be quite limited. In Queensland it grows mostly along railway lines, in old cultivation lands, and is especially a weed of orchards in the coastal parts of the State. In such places it is used to a fair extent as a chop-chop for working horses, and farmers say it is quite good in this respect, especially if mixed with a little more palatable fodder.

Poison Peach.

N.I. (Collinsville)—

The particular specimen forwarded is the common so-called poison peach of Queensland and New South Wales (*Trema aspera*). The poisonous principle in this plant is a prussic-acid yielding glucoside somewhat similar to that found in Sorghum, occasionally in Sudan grass and other fodders. The occurrence of the glucoside in the plant is very transitory and what controls its formation is not known. It is certainly more often absent than present, and this accounts for the fact that stock frequently feed on Peach bush in very large quantities without any ill effects following whatever. We carried out some tests with this plant some years ago, and found that the poisonous principle was not confined to any one month. We got most positive results in February, but got positives again in May and June, but none in January and March. In June, as well as positive tests we got negative ones.

In reply to the query raised, although we do not known what controls the glucoside in this plant, it is more likely to be present in the young than in the old, and is most likely to be abundant if a cold snap quickly follows rank growing summer weather. Certainly the symptoms as described —a very rapid death and animals dying after drinking—seem to point to prussic-acid poisoning. As to the point raised as to why young stock should be effected more than old, we think young stock would certainly be more susceptible to the poisonous property of a plant of this type than older animals.

Tie Bush.

A.W.M. (Mount Nebo)—

Wickstroemia indica, Tie Bush, so called on account of the strong fibre contained in the bark. This plant has commonly been suspected of poisoning stock. Some few years ago leaves of it were fed to heifers at the Animal Health Station, Yeerongpilly. After about a fortnight's feeding the animals became very thin and emaciated and blood was passed with the dung, but on being put on to ordinary feed they recovered. About a year ago the berries were suspected of poisoning a child at Nambour. They were fed to guinea pigs and death resulted. On this account we think the plant should be destroyed.

Flannel Weed.

F.O'B. (Pullen Vale)—

The specimen is the Flannel Weed, *Sida cordifolia,* a very common weed in Northern Queensland. Of recent years it has spread to the more southern parts of the State. We do not think it has any fodder value, although it is not known to be poisonous or harmful in any way.

"Feather-top Rhodes Grass" (*Chloris Virgata*).

T.D. (Rywung)—

The specimen is *Chloris virgata*, commonly called the Feather-top Rhodes Grass. On the whole, so far as our experience goes, stock do not take to this plant although it has a green and luscious appearance. We have heard, however, that stock will eat it readily enough made into a form of hay, but on this point we have had no personal experience. The plant becomes a bad pest in cultivation, and has considerably decreased the yield of many of the lucerne fields in the Lockyer Valley. Where ordinary Rhodes Grass will generally thrive, we think its room is preferable to its company.

Native Trees Suitable for Park or Street.

A.H.B. (Nambour)—

"Australian Rain Forest Trees" may be obtained from Barker's Book Stores or any other Australian bookseller, and is published by the Council for Scientific and Industrial Research. Copies may be obtained direct from the local secretary, Council for Scientific and Industrial Research, corner Ann and Edward streets, Brisbane. The price is 10s.

Below is a list of native trees suitable for street and park planting. The list is, of course, by no manner of means complete, and is confined to trees that can be obtained either through the ordinary commercial channels or from Government and municipal nurseries, such as the Forestry Department or the Brisbane Botanic Gardens. If you visited the local scrubs you would find a number of seedlings of different trees that could be transplanted; or, failing seedlings, you could often get from the ground a number of seeds. These could be sown and afterwards pricked off into tubes or pots. I do not think you would find many unsuitable plants, because such a large number of the scrub trees make beautiful shapely specimens when grown in the open. Pittosporum (*Pittosporum undulatum*); Red Cedar (*Cedrela australis*)—Rather hard to grow on account of attacks of Cedar Twig Borer; White Cedar (*Melia dubia*)—Grown extensively, but berries are poisonous; Crow's Ash (*Flindersia australis*)—One of the handsomest of out native shade trees; Yellow Wood (*Flindersia Oxleyana*); Moreton Bay Chestnut or Bean Tree (*Castanospermum australe*)—Much grown as a street and park tree, but seeds are poisonous to live stock; Citron Scented Gum (*Eucalyptus citriodora*); Buckinghamia (*Buckinghamia celsissima*)—A native of North Queensland. There are some beautiful specimens in Queensland streets; Queensland Nut (*Macadamia ternifolia*); Flame Tree (*Sterculia acerifolia*); Wheel of Fire (*Stenocarpus sinuatus*)—A beautiful tree, but very slow grower; Queensland Beech (*Gmelina Leichhardtii*); Kauri Pine (*Agathis robusta*); Hoop Pine (*Araucaria Cunninghamii*); Cypress Pine (*Callitris columellaris*), or other species; Figs (*Ficus* sp.)—Some of the smaller leaved sorts are excellent, though their extensive root system is a drawback; Silky Oak (*Grevillea robusta*).

Guinea Grass—Suspected Poisoning.

F.T. (Charters Towers)—

The sudden death of the calves and the thorough-bred colt point rather to prussic-acid poisoning, and it seems possible that the Guinea grass has suddenly developed this poisonous property. Send some of your local Guinea grass to the Commonwealth Stock Experiment Station, Townsville, and ask if their chemist could make a test for the presence of a prussic-acid yielding glucoside. We recommend this course because it is preferable to test this grass when fresh, and by the time the specimen reached Brisbane it would either have become very dry or very mouldy. In either case, it would not be very satisfactory for examination for the presence of a prussic-acid yielding glucoside. At the same time we are getting samples of Guinea grass from a number of different localities around Brisbane for a similar examination. The matter brought up by you, needless to say, is a very important one, because Guinea grass is one of the commonest grasses in Queensland and is again coming very much into favour. Personally, we may say that so far as our experience goes stock are extremely fond of Guinea grass, and although we have seen much of it fed have never heard of any trouble before. If we cannot find a poisonous principle in the Guinea grass, the cause of the trouble must be looked for elsewhere.

General Notes.

Staff Changes and Appointments.

Constable P. J. Purtill, of Yamba, has been appointed also an Inspector under the Slaughtering Act.

Mr. S. C. Knack, Broadmere, via Taroom, has been appointed an Honorary Inspector under and for the purposes of the Diseases in Stock Acts.

Mr. R. I. Robinson, care of Farleigh Mill, Farleigh, via Mackay, has been appointed millowners' representative on the Farleigh Local Sugar Cane Prices Board, in the place of Mr. T. G. Mulherin, who has resigned.

Mr. H. G. Mulherin, Cameron's Pocket, Calen, has been appointed to the position of canegrowers' representative on the Farleigh Local Sugar Cane Prices Board, which has been rendered vacant by the resignation of Mr. H. C. J. Hansen.

Mr. E. Richards, loader for the Committee of Direction of Fruit Marketing at Howard, has been appointed also an Honorary Inspector under the Diseases in Plants Acts.

Mr. A. Popham, Flinders lane, Townsville, has been appointed an honorary ranger under the Animals and Birds Acts.

Mr. E. H. H. George, Assistant Inspecting Check Chemist and Assistant Statistical Officer, Central Sugar Cane Prices Board, has been appointed Assistant Secretary to the Central Board.

The following Cane Testers have been appointed for the forthcoming sugar season:—P. H. Compton (Babinda Mill), Miss A. L. Levy (Bingera), T. D. Cullen (Cattle Creek), C. J. Boast (Fairymead), J. Macfie (Farleigh), T. Herbert (Gin Gin), T. Breen (Inkerman), Miss J. Orr (Invicta), L. G. F. Helbach (Isis), Miss J. O'Flynn (Kalamia), Miss D. Marles (Maryborough), Miss M. T. Smith (Millaquin), L. C. Home (Moreton), F. W. Trulson (Mossman), L. Chadwick (Mount Bauple), C. H. Jorgensen (Mourilyan), V. F. Worthington (Mulgrave), Miss I. Palmer (Pioneer), J. C. D. Casey (Plane Creek), W. J. Richardson (Pleystowe), Miss E. Christsen (Proserpine), T. P. Brown (Qunaba), J. Howard (Rocky Point), G. Tait (South Johnstone), Miss A. Walsh (Tully), R. D. Woolcock (Marian), H. T. Whitcher (North Eton), T. F. Corbett (Racecourse).

The following Assistant Cane Testers for the forthcoming sugar season have been appointed:—Miss M. A. Lyle (Babinda Mill), Mrs. M. Nally (Bingera), Miss E. Rowe (Farleigh), Miss D. Bowder (Inkerman), Miss A. Anderson (Invicta), Miss D. Aldridge (Isis), H. McAntee (Kalamia), Miss M. E. L. Wassell (Marian), D. Walton (Marian), Miss F. Foubister (Maryborough), Miss M. Thorburn (Millaquin), Miss N. Hooper (Moreton), Miss S. Wilkinson (Moreton), Miss M. Morris (Pioneer), St. C. G. Fanning (Plane Creek), Miss E. Crees (Plane Creek), Miss P. Southwick (Pleystowe), H. A. Larsen (Pleystowe), Miss T. Payne (Proserpine), Miss C. Humphreys (North Eton), C. H. Humphreys (Racecourse), Miss M. Orr (Racecourse), S. McRostie (South Johnstone), Miss A. Murray (Tully).

Mr. K. S. McIntosh (B.V.Sc. Sydney University), Lismore, has been appointed Government Veterinary Surgeon, Department of Agriculture and Stock. Mr. McIntosh will be attached to the Animal Health Station, Yeerongpilly.

Mr. A. A. Armitage and V. H. Stringer, of Bundaberg, have been appointed Honorary Rangers under the Animals and Birds Acts.

Messrs. W. L. Sanderson, J. Logan, and P. J. Brereton, members of the Eumundi Fruitgrowers' Association, Limited, have been appointed Honorary Inspectors under the Diseases in Plants Acts.

Mr. W. C. Burrowes, Clerk of Petty Sessions, Maryborough, has been appointed an Agent of the Central Sugar Cane Prices Board for the purpose of making inquiries in pursuance of the provisions of the Regulation of Sugar Cane Prices Acts regarding sales and leases of assigned lands in the Maryborough district.

Mr. C. G. Revitt, Dunk Island, has been appointed an Honorary Ranger under the Native Plants Protection Act.

New Boundaries of the Helidon and South Burnett Cleansing Areas.

An Order in Council has been issued under the Diseases in Stock Acts amending the existing boundaries of the Helidon and South Burnett cleansing areas. In the case of the South Burnett area, a portion of the Auburn-Chinchilla area has been included within its boundaries, together with a certain area of land lying between the two areas. The Helidon cleansing area will now include the Crow's Nest cleansing area.

Hail Insurance.

Regulations have been issued under the Primary Producers' Organisation and Marketing Acts adding to the Canary Seed Board Hail Insurance regulations which were issued in September, 1931. These empower the Canary Seed Board to establish a Hail insurance fund for the purpose of paying to canary seed growers compensation in respect of crop losses through hailstorm damage. The fund is created by a levy in the form of a pro rata premium charge against all growers calculated on the basis of the quantity of canary seed harvested and that on which hail compensation is payable each year, and is known as the Canary Seed Board Hail Insurance Compensation Fund. The levy is a charge against the grower, and may be a deduction from advances, but the sum chargeable in any one year shall not exceed 7½ per cent. of the total value of the canary seed insured during the same year.

All canary seed is automatically covered from the time it is fully out in ear until it is harvested, but such cover shall not extend beyond the 31st January in any year. Particulars in regard to claims for compensation and for the payment thereof are also contained in these regulations.

The regulations issued provide that crops shall not be entitled to compensation unless the same are totally destroyed, or if such crops are partially destroyed, unless they are actually harvested and the resultant grain is delivered to the Board. No crop shall be assessed in excess of 560 lb. of canary seed per acre. Further, no compensation shall be payable in respect of destruction of or damage to any crop, unless a return in the form provided has been lodged with the Board on or before the 30th September in each year. The return sets out the area planted, the area to be harvested, and other information. In any case where the Board is of opinion that good reason exists for the failure of any person to furnish a return, it will pay compensation under these regulations, notwithstanding such failure to furnish the return.

Plywood and Veneer Board.

Notice of intention to constitute a Plywood and Veneer Board was issued on the 22nd March last, and a petition invited on the question of the setting up or otherwise of such a Board, which was to be lodged by the 23rd April, 1934.

No petition was received, and Executive approval has been given to the issue of an Order in Council formally constituting a Plywood and Veneer Board for a term of one year as from the date of the Order. The Order provides for the declaration of all plywood and veneer produced in that portion of the State south of the twenty-third degree of south latitude to be commodities under the Primary Producers' Organisation and Marketing Acts, and for the constitution of a board in relation thereto. The board shall be a marketing board, consisting of ten elected representatives of the growers together with the Director of Marketing, or a deputy appointed by the Minister, and an officer of the Forestry Department. The members, except the Director of Marketing or his deputy, and the Forestry officer, shall be elected annually.

The commodities shall be vested in the Board as the owners thereof. The Board shall have authority to acquire and allocate raw material (including timber) required by producers, and shall receive and allocate to the producers, on a quota basis, as decided by the Board, all orders for the supply of plywood and veneer, and shall control the marketing thereof. The Board shall also control the appointment of agents in Queensland, the Commonwealth, and in other countries, and shall determine the remuneration of such agents.

The following have been appointed members of the Plywood and Veneer Board for the period from 3rd May, 1934, until 2nd May, 1935:—

Messrs. R. H. Bentley (Austral Plywood Pty., Ltd.), J. F. Brett (Brisbane Sawmills Pty., Ltd.), G. Brown (Brown and Broad Newstead Homes Ltd.), J. E. Christoe (Manumbar Timber Co. Pty. Ltd.), J. W. Jackson (Newmarket Plywood Co., Ltd.), W. L. Johnson (Newmarket Plywood Co., Ltd.), G. W. Nutting (Stanoply Timber Co. Pty., Ltd.), C. R. Paterson (Hancock and Gore, Ltd.), P. S. Reid (National Plywood Co. Pty., Ltd.), R. J. Donaldson (The Oxley Plywood Co. Pty., Ltd.), A. E. Gibson (Deputy for the Director of Marketing), and G. A. Duffy (Chairman, Timber Advisory Committee, Forestry Sub-Department).

Island Sanctuaries for Birds.

Holbourne Island, about 18 miles north of Cape Edgecombe, and Arkhurst, Langford, Black, and Bird Islands, situated about 30 miles north-easterly from Proserpine, have been declared sanctuaries under the Animals and Birds Acts.

Sugar-cane Assessment.

An Order in Council has been issued under the Regulation of Sugar Cane Prices Acts fixing the assessment on all sugar-cane received at mills on and after the date of this Order to be at the rate of 1½d. per ton. This rate is similar to that of last year.

Butter Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts giving notice of intention to extend the operations of the Butter Board from 1st July, 1934, to the 7th February, 1935. A petition for a poll on the question of whether or not the Board should be extended for such term may be lodged by at least 10 per cent. of the growers on or before the 19th June.

Dairy Products Stabilisation Act.

Provision is made in the Dairy Products Stabilisation Act, which was passed last session, that where, after the passing of the Act, any circumstances arise whereby it shall appear to the Governor in Council (for the purpose of giving full effect to the objects and purposes of the Act, or for the proper stabilisation of dairy products) that any amendment of the Act shall be deemed desirable, such amendment may be made by Order in Council.

An Order in Council has been issued, amending, in certain particulars, the abovementioned Act. The amendments include the insertion in the Act of definitions for the words "process," "processing," and "cheese." A new definition of "dairy product" is inserted, and the definition of "quota" is amended.

Section 9 of the Act, which empowers the Dairy Products Stabilisation Board to promulgate a quota, which should be based on the quota determined by the Minister for Commerce, has been deleted, and a new section inserted in its place. This omits the reference to the necessity for basing the quota on that determined by the Minister for Commerce.

Minor amendments are made in section 10.

A new section (19A) provides that for the better enforcement of the Act, and in addition to any other provision in the Act in that behalf contained, the Supreme Court may, on the application of the Board, make any such order as it deems just and necessary in the nature of a mandamus or injunction to compel compliance with or restrain a breach or continuance of a breach of any of the provisions of the Act or Order in Council thereunder or of any lawful determination of the Board, and all necessary powers, authorities, and jurisdiction of the Supreme Court shall apply and extend herein and are vested in the Supreme Court accordingly.

Egg Board.

A regulation has been issued under the Primary Producers' Organisation and Marketing Acts, extending the Egg Board Levy Regulations for the period from 1st January, 1934, to 31st December, 1938. These regulations were issued in April, 1929, and extended until 31st December last, and empowered the Egg Board to make a levy at the rate of ½d. per dozen on all eggs delivered to the Board. The sums raised by the levy are used for administrative purposes of the Board.

Dairy Product Manufacturer Defined.

"The Dairy Products Stabilisation Act of 1933" provides that a "manufacturer" shall mean a person who manufactures in the State such weight of dairy products for sale as may from time to time be prescribed by Order in Council in any period prescribed by Order in Council. An Order in Council has been issued under the Dairy Products Stabilisation Act prescribing that the weight of dairy products aforesaid shall be ten pounds and that the period shall be one week. Accordingly, a manufacturer of dairy products shall manufacture within the State ten pounds of dairy products for sale in any one week.

Milk and Cream Testing Examination.

An examination of Certificates of Proficiency under "*The Dairy Produce Acts, 1920 to 1932*" in the subjects of milk and cream testing, milk grading, cream grading, butter making and cheese making, will be held on Saturday, 28th July, 1934, in centres that will, as far as possible be arranged to suit candidates, who should notify the undersigned not later than the 12th July. Entrance fee 5s. for each subject should accompany the application, with an additional 10s. 6d. if a special centre is desired. Candidates must not less less than eighteen years of age on the day of examination.

Rural Topics.

The Gestation Period of Brood Sows.

Data obtained locally and from various parts of the world prove the normal gestation period of the breeding sow—that is, the time that elapses between date of successful service and actual date of birth of the litter is 112 days, sometimes spoken of as three months, three weeks, and three days. It is frequently noticed that pigs that are carried over the normal gestation period have sharp black milk teeth when born, which they use, injuring the teats and udders of the sow, making her restless and inducing her to refuse to allow her young to suckle. It sometimes happens that the sow suffers such pain that she loses control of herself and will turn round suddenly and snap and bite the young pigs, sometimes breaking their ribs and limbs and causing much injury, which it is difficult to overcome. To prevent undue pain and distress to the sow and to protect the young pigs against themselves, these sharp black teeth should be cut off with a pair of tooth nippers when the pigs are a few days old. If they are left untouched it is possible that the sow may refuse to suckle her litter at all, and thus milk fever and inflammation of the teats and udders of the sow follows. Removal of the tusks of older pigs is also advised, though it is a much more difficult operation and can only successfully be carried out by an experienced hand.—E. J. SHELTON, H.D.A.

To Prevent Over-cropping in the Orchard.

Because of the light crop in many orchards this season, the trees will probably show an abundance of blossom buds in the coming spring, and if over-cropping is allowed to occur the fruit the next season will be small and of poor quality, whilst the reduced vitality of the trees will prevent a satisfactory crop the year following.

Whilst it may not be possible to prevent alternate cropping, it is possible, by means of pruning and judicious thinning of the spurs—supplemented by hand-thinning, if necessary—to prevent over-production of fruit, which not only reduces size and quality, but is one of the causes of alternate bearing of pome fruit.

The weakening effect of an abnormally heavy blossoming—even when no fruit set—was strikingly illustrated on several occasions recently with pear trees. Portions of the trees were heavily spur pruned, in some instances as much as 80 per cent. of the blossom buds being removed, and the limbs so treated not only carried a good crop of fruit but also made a fair amount of new wood growth, whilst unpruned portions of the trees, though a mass of bloom, failed to set any fruit or to make any wood growth.—A. and P. Notes, N.S.W. Department of Agriculture.

Fistulous Withers.

An article on fistulous withers in horses in the current issue of the New South Wales *Agricultural Gazette*, contains a point of very great interest to dairy farmers, namely, the relationship which exists between fistula of the withers of horses and contagious abortion of cattle.

In 1919 some German scientists reported that they had discovered a relationship between fistula of the withers in horses and contagious abortion in cattle. These workers discovered that the germs of contagious abortion of cattle were frequently present in the pus of horses affected with fistula. In 1928 this discovery was confirmed in France, and in 1930 similar confirmation came from America and Holland. In 1931 veterinarians in Western Australia reported the first association of these two diseases in that State, and in 1932 our own Veterinary Research Station at Glenfield obtained similar results. Similar reports have also come from England and from Sweden.

It is now accepted throughout the world that there is a definite relationship between contagious abortion in cattle and fistula of the withers of horses. This very interesting discovery is of extreme importance to horse owners and to dairy farmers for the reason that horses running on farms where contagious abortion is present would be liable to contract fistula of the withers. But more important still is the fact that a horse with a discharging fistula may spread millions of microbes of contagious abortion which are readily picked up by cattle to infect them with contagious abortion.

It is of some interest, too, that the large swellings (known as hygroma) which occasionally occur on a cow's knee very frequently contain precisely the same germ, and when these burst to discharge they serve an active means of spreading this all too prevalent germ.

Points in Lamb Marking.

The main consideration in lamb-marking, apart from the prevention of actual mortality, is the avoidance of any decided check in the growth of the lamb. Lambs should be marked as early as possible so long as they are healthy and active; if the operation is left too long there is more chance of a setback from loss of blood. The operation should be performed in the morning so that the lamb will have the bulk of the day in which to find its mother. If it is left until late in the day losses are likely to occur, especially if the night is cold.

The sheep should be mustered some time before the operations commence and the lambs allowed to settle down. There should be no rushing about, and dogs should be used as little as possible, as deaths from hemorrhage are very common when lambs are marked in an excited and overheated condition.

Cleanliness is vital in lamb-marking—heavy losses from various infections take place annually through sheepowners' failure to recognise this fact. The knife used for docking and tailing calls for special attention.

The most suitable type has the blade and handle all in one piece, but in any case it should be as plain and as sharp as possible, since germs may be harboured in joints or corners and even in cracks in the blade or in slight irregularities in the cutting edge. Prior to the commencement of the operations the knife should be boiled, and it should be carried to the yards in the liquid in which it was boiled. Throughout the marking the knife should be dipped as frequently as possible in a carbolic solution or other disinfectant; and whenever it is out of the operator's hand it should be allowed to remain in the disinfectant.

Dirty yards are a breeding ground for various dangerous organisms, and the choice of the site for the operation is therefore important. It should be perfectly dry and well away from dust and dirt so as to minimise the risk of losses from lockjaw and blood-poisoning, and if the flock is not too large it is best to use temporary yards made of movable hurdles or wire-netting and stakes, in a fresh paddock each year. With large flocks this is perhaps impracticable, and the following treatment of the yards is recommended:—Remove the surface soil of the yards to a depth of about 6 in., and place it in a heap, where it should be thoroughly mixed with quicklime; then saturate the fresh surface exposed with a strong solution of non-poisonous sheep dip.

In addition to the above precautionary measure it is essential to adopt some means of preventing the germs of disease from gaining entrance into the flesh-cuts made in the scrotum and tail. As the yards, although the main, are not the only source of infection, it is recommended that wounds of the scrotum and tail be either smeared with tar or dressed with carbolised oil (1 part of carbolic acid to 12 parts of oil) before the lamb is released after the operation. This is most important.

Lambs dead of tetanus or other of the inoculable diseases commonly contracted during marketing, if not destroyed, form fresh centres of infection by absorption of the micro-organism by the earth. All carcasses should therefore be destroyed by burning.

When marking lambs in temporary yards or in a corner of a paddock, care must be taken that the ewes are not allowed to spread too far in the paddock before the lambs are released. Although it is inadvisable to keep the ewes and marked lambs in a yard for any length of time after marking, a little shepherding of the flock in the paddock will repay the owner by ensuring that the lamb obtains a drink of milk as soon as possible after the operation. Very often it is found that a number of lambs which are possibly more seriously affected by the operation will hang about the gates of the yard, and if the ewes are not kept handy for at least a little while these lambs will probably become isolated and lost.—A. and P. Notes, New South Wales, Department of Agriculture.

Care of the Separator.

The operation of the separator and the care devoted to its cleansing have a material effect on the quality of cream produced. On no account should the separator be left overnight without being dismantled, and all parts thoroughly cleansed and scalded. After separating, all utensils and separator parts with which milk has come in contact, including the vats, buckets, and strainer, should be washed with slightly warmed water and then submerged in boiling water and placed on racks to drain. The practice of wiping over the utensils with a cloth after scalding only serves to undo the work of sterilisation and to re-infect with bacterial organisms.

Milk should not be left lying about on the floor or under the separator block, and the surroundings should be kept sweet and clean, and the drains free to carry away the floor washings.

Deodorising of Cream—Farmers' Responsibility.

Considerable interest is being shown in the installation of deodorisers at some of the New South Wales butter factories, but the belief current in some places that these machines will relieve the dairy farmer of the necessity for care in the production of cream should be most strongly discountenanced, observes the "Agricultural Gazette" of New South Wales.

Unfortunately, much cream used in the production of choicest butter has been below choicest quality, and farmers have been paid highest butter prices for cream which, if used alone in the production of butter, would not have produced this quality. It has only been made possible to pay these prices for "border-line" cream by the fact that the percentage of good cream has been considerably greater than that of inferior cream. When these two qualities have been mixed together, or blended, and subsequently neutralised and pasteurised, a bare choicest grade butter have been produced.

The supplier of the lower grade cream may thank his careful neighbour and the pasteuriser for his good luck in obtaining the best price. It is certainly not playing the game for the careless supplier to impose on his more careful neighbour, for that is what it really amounts to. If his example should be followed generally, it would not be long before the point was reached—and there are evidences of it to-day in some places—that the quantity of good cream may be insufficient to permit of satisfactory blending of the different qualities. Under such conditions the general quality of the butter will undoubtedly suffer.

With the advent of the process of deodorising cream there is an impression in some quarters that the farmer will be relieved of the need of any care, and for the future he will be able to rely upon the deodorising machine to remove any and all faults, whether they be due to his neglect or to his bad management. The deodoriser is a valuable machine and was primarily developed for the elimination of vegetable chemical contaminations, which it does thoroughly, but it should not be regarded as a means by which to abstract the taints produced by the presence of objectionable microorganisms which have developed in the cream as the result of insanitary conditions or careless methods of production.

Care and scrupulous cleanliness, together with control of cream temperature, are just as necessary to-day on the part of the dairy farmer as they have always been. He must not expect mechanical appliances in the factory to remove faults which he himself can prevent by the exercise of common cleanliness and common sense. Given this attention the pasteuriser and deodoriser will remove any feed taints and so improve his cream that the production of choicest quality butter is reasonably assured.

Work in the Citrus Orchard.

The low returns received by citrus growers during the past two seasons has forced upon them a realisation of the fact that the utmost economy must be practised in production methods. There is at least one direction in which improved production can be achieved without increasing expenditure, and that is by producing fruit of a better commercial size (write officers of the Fruit Branch of the New South Wales Department of Agriculture in current notes). In coastal areas too great a proportion of citrus fruits is on the small size. Satisfactory size in fruit is mainly dependent on sufficient soil moisture and a thrifty tree condition.

Increasing the soil's capacity to retain moisture in established groves is possible only by increasing the organic content of the soil. In soil so improved the trees are enabled to send their roots down to a deeper feeding zone. In this connection the value of green manure crops should not be overlooked.

In green manuring trials carried out over several years and in many different types of soils purple vetch has proved a vern consistent and heavy producer. During wet seasons on the coast it is much more reliable than field peas. A sowing of from 10 to 20 lb. purple vetch seed per acre is economical, especially if drilled in with 1 cwt. of superphosphate. Under inland conditions the tick bean is the most satisfactory green crop. Many orchardists rely on weed growth for the supply of organic matter, but this is not sufficient, as is evidenced by the fact that many trees growing under such conditions are difficult to maintain in a thrifty state.

Another factor that assists in the satisfactory development of citrus fruits is the maintenance of the leaf-bearing area of the trees. In this relation timeliness of spraying may have a not unimportant influence. When spraying operations are delayed, heavier applications than would otherwise be necessary have to be used. Particularly is this the case where white wax scale has to be combated, where if control measures are so delayed that it becomes necessary to use larger amounts of soda or to have recourse to the use of certain spray oils, defoliation in some degree may result.

PLATE 170.—DEPARTMENT OF AGRICULTURE AND STOCK CRICKET CLUB.

Premiers 3C Grade, Q.C.A. (Warehouse Division), 1933-34.

Front Row.—R. Wilson (Assistant Under Secretary, Department of Agriculture), E. Taylor, R. Taylor (Captain), J. P. Orr (Chairman, Sports Club), F. Bell (Vice-Captain), L. Smith, H. Hunter (Chairman, Cricket Club).

Second Row.—W. E. Hamley (Hon. Secretary), A. C. Peel, R. Pritchard, D. S. Davis, T. McKnight, L. Burgess.

Back Row.—H. Gardam, E. Burns. Inset.—W. Palmer.

Feed Economy of Food Production.

One of our subscribers recently came to us with a question concerning the efficiency of farm animals in converting feed into human food.

Jordan has summarised the data bearing on this subject in his book, "The Feeding of Animals." After having studied the data available, and by using comparable methods of comparison, he presents the following data as indicating the relative efficiency of farm animals in converting a given amount of feed into human food:

PRODUCED BY 100 LB. OF DIGESTIBLE ORGANIC MATTER IN RATION.

Animal.	Marketable Product.	Edible Solids.
	Lb.	Lb.
Cow (milk)	139·0	18·0
Pig (dressed)	25·0	15·6
Cow (green cheese)	14·8	9·4
Calf (dressed)	36·5	8·1
Cow (butter)	6·4	5·4
Poultry (eggs)	19·6	5·1
Poultry (dressed)	15·6	4·2
Lamb (dressed)	9·6	3·2
Steer (dressed)	8·3	2·8
Sheep (dressed)	7·0	2·6

To dairy farmers the most noticeable fact brought out by this comparison is the position of the dairy cow in respect to feed economy of food production. Out of ten live stock food products the dairy cow with her milk, green cheese, dressed calf, and butter occupies the first, third, fourth, and fifth positions.

When it comes to producing edible solids in the form of meat, swine are far more efficient than other farm animals, being a close competitor even to the dairy cow if compared with milk. It is interesting to note that the growth of a pound of edible beef solids requires a feed expenditure of nearly seven times as great as is necessary for the elaboration of a pound of milk solids.

Thus it may be stated that the dairy cow is not only the most efficient producer of human food but also she produces the most nearly perfect food. These facts should be kept well in mind by dairy farmers.—"Hoard's Dairyman."

Points for the Sheep Man.

Whether he is producing fine, medium, or strong wool, it should be the aim of the breeder to see that it has pronounced quality for its type, points out an officer of the Sheep and Wool Branch of the New South Wales Department of Agriculture in the "Agricultural Gazette." In order to produce such wool, and a good type of flock sheep, it is essential that graziers give strict attention to details when breeding. The main requirements are summarised in the following advice:—

Do not be dictated to by fashion; breed the type of sheep that is suitable to your district.

Do not mate extremes.

Do not try to achieve in one year that which normally takes three or four years of careful selection and breeding.

Select good sires. Make certain that the sire is good on the points and underneath; too many rams are bred which are weak in these respects.

Remember that in the case of many small flocks one of the main faults is lack of density, indicated by spindly wool on shoulder and point. Therefore, good rams showing a fair amount of development are needed.

Cull fairly heavily in order to produce a wool displaying all-round quality.

Do not pamper your sheep and deceive yourself.

Do not judge a stud by its stud sheep, but rather by its flock sheep.

The Home and the Garden.

OUR BABIES.

(Issued by the Queensland Baby Clinics.)

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

OUR INVISIBLE ENEMIES.

OUR worst enemies are those we cannot see. Some we cannot see even with the microscope. Yet science has learnt much, and we are by no means defenceless. It is not many years since infectious diarrhœas were the principal cause of an enormous infant mortality. The ways in which these germs got into infants' food were discovered, and by simple precautions, of which natural feeding is the most important, the mortality from this cause has been reduced to a very low figure. More infants die now from bronchitis and pneumonia than from diarrhœa. Very little, almost nothing, is being done to prevent these deaths.

The Common Cold.

In children bronchitis and pneumonia nearly always follow some other infection, of which the most frequent is the "common cold." All three are caused by disease germs, but the germ of a "cold" is the pioneer that clears the road. Every winter this germ is specially active.

How It Spreads.

Some people are afraid of catching "colds" from exposure to the weather. They are deluded. "Colds" are rarely caught out of doors. We get them by sitting in closed rooms with other people who are carrying the germs in their air passages. Whenever they cough, a fine, invisible spray floats around them and we inhale it. The more people there are in the room the greater is the risk. 'Colds" may be spread among children by kissing and fondling, and by the child who puts his fingers in his mouth and smears them on his playfellow's face. It is easy to understand why "colds" are more frequent in winter.

How to Prevent Infection.

None of us can avoid these germs altogether, but we can avoid taking an overdose of them. The healthy body has powers of resistance, but only to a limited extent. A few germs are easily destroyed and may even increase our resistance, but a massive infection overcomes it.

Therefore, those who suffer from a "cold," if they cannot keep at home should keep their distance, and smother their coughs in their handkerchiefs. Babies and young children should be kept away from crowded rooms and halls. Children should be taught very early to keep their fingers out of their mouths. How little do we practise these simple precautions! We have known infants to be passed round large family gatherings like a church plate to collect not threepenny-bits but the pooled germs of the whole assembly!

How to Increase Resistance.

We must not only avoid massive infections, we must raise our children's resistance to the highest point. We must do this early, and not wait till they suffer from chronic catarrhs, diseased tonsils, and adenoids. Resistance is increased by healthy living—that is by plenty of fresh air and sunshine, open windows, sensible clothing (not over-clothing), and especially by good food. In particular give the child plenty of milk, a fair allowance of butter, green vegetables, some uncooked fruit, whole wheat or a daily spoonful of cooking bran (after two years of age). If he is not very strong give him cod liver oil or some substitute rich in vitamin.

Sweetmeats Lessen Resistance.

We all know how 'colds'' spread through the schools. A careful observer in Scotland noted that during the war, when sugar was severely rationed and sweetmeats were unobtainable, cases of catarrh of more than seven days' duration in a large boarding-school for girls were reduced by two-thirds. Since then he has made further observations and found that the occurrence of catarrhs was roughly proportionate to the sugar intake. Among schoolgirls who averaged about 1 lb. of sugar a week the catarrhal rate was 5·5 per cent. Among those who averaged about 2 lb. the rate was 24·6 per cent., more than four times as great. Whether their resistance was lowered by too much sugar, or by the sugar spoiling their appetites for vitamin-containing foods, is uncertain, but in either case sugar had done harm.

IN THE FARM KITCHEN.

CURRY AND RICE.

Materials—1 lb. bladebone steak or 1½ lb. neck chops; 1 onion; 1 apple; 1 tablespoonful dripping; 1 dessertspoonful flour; 1 tablespoonful sultanas; ½ lemon; 1 tablespoonful curry powder; 3 gills water; 1 dessertspoonful vinegar.

Utensils—Knife; board; saucepan; fork; wooden spoon; dish; basin.

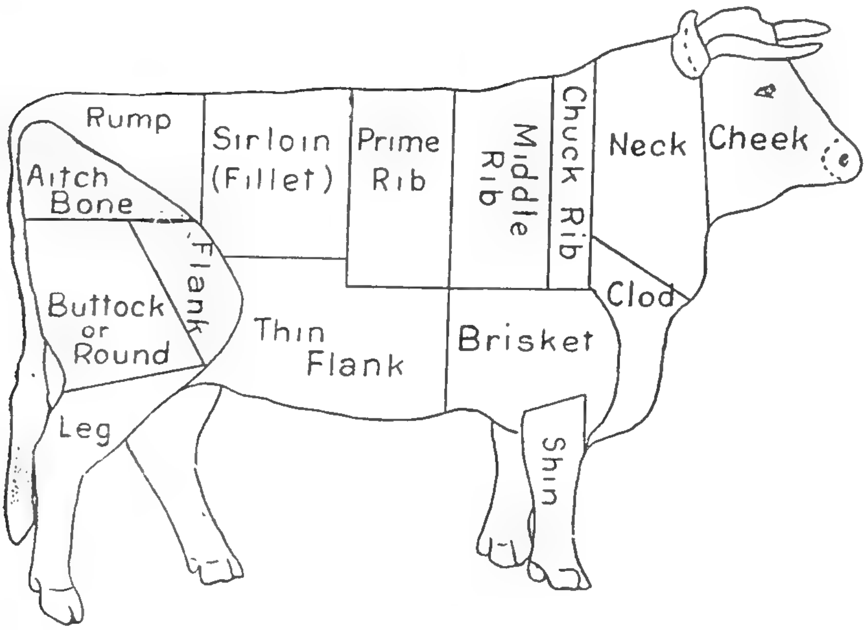
Method—

1. Cut up steak into strips or squares about ½ an inch thick; or trim chops, removing fat.
2. Peel and cut up the apple and onion; heat fat in a saucepan.
3. Add meat; fry it until both sides are brown; lift it out; put it on a plate.
4. Put into the hot fat the flour, apple, onion, sultanas, grated rind of lemon, and half the curry-powder.
5. Fry until all the ingredients are partly cooked; add water; bring to boiling point, stirring constantly.
6. Add meat; simmer for 1½ hours, taking care that the curry does not burn.
7. Add the remainder of the curry-powder, blended with vinegar; stir well; boil for 5 minutes.
8. Serve on a hot dish with a border of boiled rice round the curry.

Notes—

1. 1 tablespoonful of chutney may be used instead of the apple or sultanas.
2. Any kind of meat, poultry, or fish may be curried similarly; if cooked meat is used, a shorter time may be allowed for simmering.

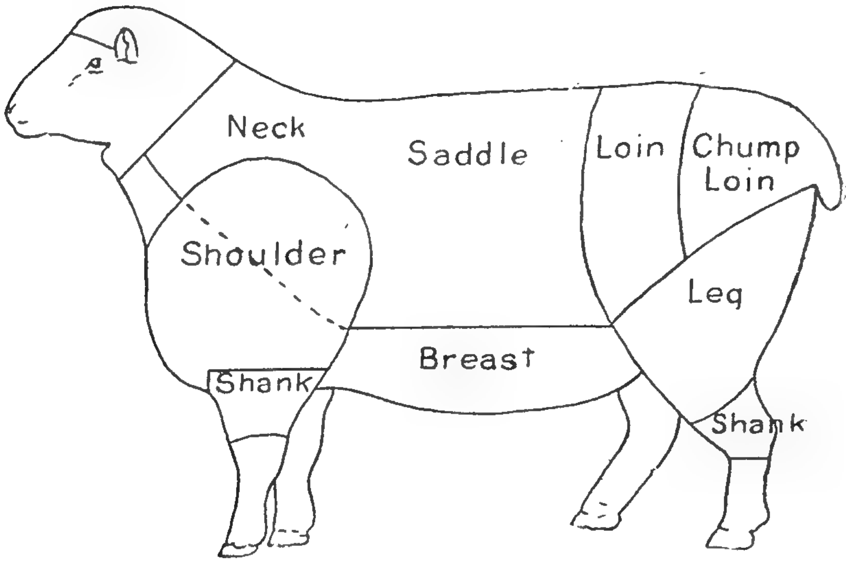
CUTS OF BEEF.



Methods of Cooking Beef.

Roasting or Baking.	Braising.	Boiling.	Stewing.	Frying or Broiling.	Salting or Spicing.	For Brawn.	For Soup.
Sirloin ..	Round ..	Flank	Clod ..	Rump	Chuck-rib	Leg ..	Round
Ribs ..	Aitchbone	Thin Flank	Flanks	Round	Round ..	Shin ...	Clod
Aitchbone	Flank ..	Brisket	..	Aitch-bone	Brisket	Cheek ..	Leg
Round ..	..	..	..	..	..	..	Bones
..	..	Round	Neck	Fillet..	Thin Flank	..	Flanks

CUTS OF MUTTON.



Methods of Cooking Mutton.

Roasting or Baking.	Braising.	Boiling.	Frying or Broiling.	Salting.	For Soup.
Leg ..	Neck ..	Leg ..	Leg chops ..	Leg ..	Bones
Shoulder	Chump loin	Neck ..	Loin chops ..	Breast ..	Shank
Loins ..	Shoulder ..	Breast ..	Neck chops ..		

Processes of Cooking and Preserving Meat.

Term.	Process.	Directions.
1. Baking or Roasting	1. Put dripping into baking dish; heat. 2. Roll meat in flour, pepper, and salt. 3. Place on trivet over hot dripping in baking dish. 4. Put into oven.	1. The oven must be very hot when the meat is put in. 2. After 10 minutes heat must be moderated. 3. Allow 15, 20, or 25 minutes for each lb. and 15, 20, or 25 minutes over. 4. Baste every half hour.
Braising ..	1. Place dripping and cut-up onions in saucepan. 2. Add meat rolled in flour, pepper, and salt. 3. Place over fire; brown slightly, pour off dripping; add water. 4. Cover saucepan and place on fire. 5. Add vegetables about ¾ hour before the meat is cooked; add salt to taste.	1. Only remove lid when necessary. 2. Take care that vegetables are not overcooked. 3. After 20 minutes heat must be moderated. 4. Allow 20 minutes for each lb. and 20 minutes over.
Broiling or Grilling	1. Trim meat or fish to the required thickness and shape. 2. Rub over the bars or wires of a gridiron with butter or dripping 3. Put meat on the gridiron. 4. Cook over a clear open fire, placing the meat as close to the fire as possible. 5. Sprinkle with salt and pepper and add small pieces of butter.	1. The fire must be hot and clear. 2. The meat must be turned often. 3. A double gridiron is best as juices escape if a fork is used to turn the meat. 4. Allow 5 to 10 minutes for cooking.
Boiling ..	1. Put fresh meat into boiling water. 2. Boil hard for 5 minutes. 3. Reduce heat of fire; add salt; remove scum; cover saucepan. 4. Simmer. N.B.—Put salt meat into cold water.	1. Water must be boiling. 2. Red meat must simmer 20 minutes for each lb. and 20 minutes over. 3. White meat and corned round must simmer 25 minutes for each lb. and 25 minutes over. 4. Corned brisket must simmer 30 minutes for each lb. and 30 minutes over.
Stewing ..	1. Fry cut up onions and vegetables in dripping in a saucepan; pour off dripping. 2. Remove fat from meat. 3. Cut meat into convenient pieces. 4. Put meat into saucepan with vegetables. 5. Add sufficient water to cover; simmer. 6. Before serving add pepper, salt, and blended flour.	1. The fire must be slow. 2. Stew must simmer for 2½ hours.

1. For baking beef and mutton allow 15 minutes for each lb. and 15 minutes over.
For baking veal and lamb allow 20 minutes for each lb. and 20 minutes over.
For baking pork allow 25 minutes for each lb. and 25 minutes over.

PROCESSES OF COOKING AND PRESERVING MEAT.—*continued.*

Term.	Process.	Directions.
Frying ..	1. Heat dripping to smoking point. 2. Roll meat in flour, pepper, and salt. 3. Put meat into smoking dripping over fire.	1. Dripping must be very hot and sufficient to cover meat. 2. Turn meat twice. 3. Allow 15 minutes for cooking.
Salting ..	1. Rub salt, brown sugar, and saltpetre into meat. 2. Place meat in a barrel or wooden tub. 3. Turn meat daily in its liquor.	1. One lb. salt to ½ lb. brown sugar and ½ oz. saltpetre. 2. Rubbing must be thorough. 3. A barrel or wooden tub is necessary.
Spicing ..	1. Rub into meat, salt, saltpetre, pepper, and pimento. 2. Place on large dish. 3. Rub and turn daily.	1. Half oz. saltpetre to 1 lb. salt. 2. Meat must be kept on a delf or enamel dish.
Brawn ..	1. Cut away meat from leg and shin. 2. Divide into convenient pieces. 3. Saw bones into small pieces. 4. Put meat and bones into a boiler. 5. Cover with cold water; boil; skim. 6. Add salt, pepper, and spices. 7. Turn out into large dish; remove bones; cut meat into small pieces. 8. Pour into dishes to set.	1. Cold water must be used. 2. Meat must simmer for 5 hours.
Soup ..	1. Break up bones and cut meat into small pieces. 2. Put into boiler; cover with cold water; add salt; allow to stand for 20 minutes. 3. Bring slowly to the boil: remove scum. 4. Add barley, rice, or macaroni and vegetables cut small. 5. Simmer for 3 hours; season with pepper and salt before serving.	1. Cold water must be used. 2. Bones must be broken up into small pieces. 3. Scum must be removed. 4. Soup must simmer for 3 hours. 5. Allow 2½ cups of water to 1 lb. of meat and bones.

BOILED RICE.

Materials—1 cup rice; 1 dessertspoonful salt; ½ teaspoonful lemon juice; 6 cups water.

Utensils—Saucepan; basin; strainer.

Method—

1. Put water on to boil in a large saucepan.
2. Wash rice in three waters; put it into the saucepan when the water is boiling.
3. Add salt and lemon juice; boil hard for 15 minutes.
4. Strain; return rice to saucepan to reheat and dry.

FLOWER GARDEN.

Winter work ought to be in an advanced state. The roses will not want looking after. They should already have been pruned, and now any shoots which have a tendency to grow in wrong directions should be rubbed off. Overhaul the ferneries, and top-dress with a mixture of sandy loam and leaf mould, staking up some plants and thinning out others. Treat all classes of plants in the same manner as the roses where undesirable shoots appear. All such work as trimming lawns, digging beds, pruning, and planting should now be got well in hand. Plant out antirrhinums, pansies, hollyhocks, verbenas, petunias, &c., which were lately sown. Sow zinnias, amaranthus, balsam, chrysanthemum tricolour, marigold, cosmos, cockscombs, phloxes, sweet peas, lupins, &c. Plant gladiolus, tuberoses, amaryllis, pancratium, ismene, crinums, belladonna lily, and other bulbs. Put away dahlia roots in some warm moist spot, where they will start gently and be ready for planting out in August and September.

No time is now to be lost, for many kinds of plants need to be planted out early to have the opportunity of rooting and gathering strength in the cool, moist spring-time to prepare them for the trial of heat they must endure later on. Do not put your labour on poor soil. Raise only the best varieties of plants in the garden; it costs no more to raise good varieties than poor ones. Prune closely all the hybrid perpetual roses; and tie up, without pruning, to trellis or stakes the climbing and tea-scented varieties, if not already done. These and other shrubs may still be planted. See where a new tree or shrub can be planted; get these in position; then they will give you abundance of spring bloom. Renovate and make lawns, and plant all kinds of edging. Finish all pruning. Divide the roots of chrysanthemums, perennial phlox, and all other hardy clumps; and cuttings of all the summer bedding plants may be propagated.

Sow first lots, in small quantities, of hardy and half-hardy annuals, biennials, and perennials, some of which are better raised in boxes and transplanted into the open ground. Many of this class can, however, be successfully raised in the open if the weather is favourable. Antirrhinum, carnation, picotees, dianthus, hollyhock, larkspur, pansy, petunia, *phlox Drummondi*, stocks, wallflower, and zinnias, &c., may be sown either in boxes or open beds. Mignonette is best sown where it is intended to remain. Dahlia roots may be taken up and placed in a shady situation out of doors; plant bulbs such as anemones, ranunculus, fresias, snowflakes, ixias, watsonias, iris, narcissus, daffodil, &c. The Queenland climate is not suitable for tulips.

To grow these plants successfully it is only necessary to thoroughly dig the ground over to a depth of not less than 12 inches, and incorporate with it a good dressing of well-decayed manure, which is most effectively done by a second digging; the surface should be raked over smoothly so as to remove all stones and clods, thus reducing it to a fine tilth. The seed can then be sown in lines or patches as desired, the greatest care being taken not to cover deeply; a covering of not more than three times the diameter of larger seeds, and a light sprinkling of fine soil over small seeds, being all that is necessary. A slight mulching of well-decayed manure and a watering with a fine-rosed can will complete the operation. If the weather prove favourable, the young seedlings will usually make their appearance in a week or ten days; thin out so as to leave the plants (if in the border) at least 4 to 6 inches apart.

KITCHEN GARDEN.

Should showery weather be frequent during July, do not attempt to sow seeds on heavy land, as the latter will be liable to clog, and hence be injurious to the young plants as they come up. The soil should not be reworked until fine weather has lasted sufficiently long to make it friable. In fine weather get the ground ploughed or dug, and let it lie in the rough until required. If harrowed and pulverised before that time, the soil is deprived of the sweetening influences of the sun, rain, air, and frost. When the ground has been properly prepared, make full sowings of cabbage, carrot, broad beans, lettuce, parsnips, beans, radishes, leeks, spring onions, beetroot, eschalots, salsify, &c. As westerly winds may be expected, plenty of hoeing and watering will be required to ensure good crops. Pinch the tops of broad beans which are in flower and take up peas which require support. Plant out rhubarb, asparagus, and artichokes. In warm districts it will be quite safe to sow cucumbers, marrows, squashes, and melons during the last week of the month. In colder localities it is better to wait till the middle or end of August. Get the ground ready for sowing French beans and other spring crops.

The continued production of rhubarb may be greatly assisted by giving a heavy mulching of manure and hoeing it well into the soil. Keep the beds well watered, and give regularly a dressing of liquid manure, say, once a week.

It is not necessary to use forcing manures on the young stock, as plants are ruined if forced in the early stages of growth.

The rhubarb makes rapid growth during the autumn and spring, and when stalk cutting has been started liquid manuring and manuring may be given.

NOTES ON ROSE CULTURE.

The following notes on rose culture are taken from the Pacific Nurseries (Messrs. C. W. and A. C. Heers), Manly, Brisbane:—

Time for Planting.—From May until the end of September. For the coastal, excepting perhaps the Central and North, we specially recommend the later period, and, in support, advance the following reasons:—

Every horticulturist must admit that all roses, particularly in the coastal area of Queensland, invariably exhibit luxurious and succulent growth and wealth of bloom during the months of March, April, May, and early June. This being so, we contend that as the plants are full of flowing sap they are not in a fit condition for transplanting during that period. There are, however, odd seasons when plants ripen earlier. In such circumstances, we would not object to extra early planting, but consider May and June do not give the plants time to establish themselves sufficiently to withstand the approaching winter.

Roses planted during the earlier months readily respond to the warm periods which assuredly occur in the middle of our winter, only to be as surely struck by our colder and more frosty days during the latter part of the winter. This shock not only checks the growth, but actually kills the tender white jelly-like roots then in the forming. There can be only one result—a plant with stunted growth upon which the foundations of your future tree has to be built. Remember, if these plants are left undisturbed in the nursery they remain dormant.

On the other hand a thoroughly rested and ripened plant, transplanted during late July, August, or September, according to the trend of the season, is ready to break away into full and vigorous growth as the warmth of Spring appears, never to look back.

We readily admit that the rose, being a hardy plant, may even do well when planted early, but after much experience we prefer to pin our faith to late planting, in most parts of Queensland where our winter is so variable. Holding these views, we hope clients will follow our advice and plant late in the season, say, from the middle of July to the middle of September. However, from Rockhampton north, earlier planting may be preferable.

Roses planted during September and even October will do quite well; if planted this late they should, however, be provided with artificial shade and kept well watered until they are established.

It is gratifying to us to know that quite a number of clients, after acting upon our advice, write to say how pleased they are with their experience of late planting; so we reiterate—do not plant or prune roses too early in Queensland, especially along eastern slopes south of Bundaberg.

We must warn people that early planting is the cause of many failures, therefore, do not complain if you ignore our advice.

Selecting Varieties.—When making selections consult our brief descriptions and ascertain the variety's suitableness regarding its growth, style, colour, fragrance, and freedom of bloom. If you are not acquainted with the various varieties listed it will pay you to leave selection to us, mentioning any varieties you may already have. You will find a special list on the inside of the front cover, giving our choice in each colour.

Planting.—Roses should never be planted when the ground is sodden, as the soil glues together and excludes the air so necessary for the future welfare of the plant. Rather delay planting, and in the meantime bury the whole plant lengthwise, cover completely with soil and await more favourable conditions. It is surprising how long plants may be kept by this method.

Although roses do well under almost any condition, it will always repay you to trench and drain the ground. However, should the ground be flat and unsuitable for drainage, it is better to dig it a foot deep and raise the bed. Such beds require hardwood or concrete borders, otherwise the outside plants dry out too easily. Work in a liberal supply of well-rotted cow or stable manure. This work should be done at least four weeks prior to planting. Plant so that the union will be just under the surface of the ground. In the case of light sandy soil it is an advantage to have the union as much as 2 inches below the surface. Never, on any account, place fresh manure or any form of fertilizer near the roots at the time of planting.

The roots should be evenly spread and so arranged as to give them a downward tendency; cover with about 3 inches of fine soil and press down firmly; fill in and give a liberal supply of clean water. Keep the earth away from the graft until the plant strikes; in the meantime, mulch with straw in order to protect union and keep the soil from caking. Cover the outside edges of straw with soil to keep it in position.

The mulch also creates an ideal condition for further waterings. Should the weather continue dry, it will be necessary to water at intervals, according to the conditions. Do not use fresh manure or artificial fertiliser near the roots when planting. Should the sun's rays become hot after planting, it is advisable to provide the plant with artificial shade.

Suckers.—Always keep a sharp lookout for brier suckers, which may from time to time sprout from below the graft. These are readily detected by their foliage, and if not removed they will in time kill the rose tree. *However, on no account must any new rose growth from the base be interfered with.*

Manuring.—Roses should be heavily manured at least once a year, well-rotted animal manure being the best. It should be spread over the bed and lightly forked in. Bone dust and other suitable fertilizers are also beneficial. Established rose trees are greedy feeders, and periodical light dressings of fertilizer, applied during damp weather, will give good results. Heavy soil needs occasional dressings of lime, which, however, should not be used within a month or so of fertilizers.

Pruning.—There is no phase of rose culture more difficult to impart than that of pruning. After accepting the broad principles generally laid down, make a close study of the habits and peculiarities of the various types of roses. Apply commonsense methods and observe and profit by the results obtained. We are opposed to early pruning in this State for similar reasons to those advanced against early planting. However, varieties with H.P. strain may, if the canes are sufficiently ripened, be shortened during March or April to from 3 to 5 feet from the ground—the weaker the shorter. This will ensure a wealth of bloom in the late autumn. For the annual overhaul the end of July and August is the best time. Hard pruning, as practised in cold countries, must not be generally applied here. The reason is not far to seek, as the periods of inactivity are short and uncertain. Make the prevailing conditions your guide as to how and when to prune. Assist the pruning problem by observing the following golden rules during the entire season:—

(1) Cut away dead, spindle wood; (2) always cut blooms and stems that have bloomed well back to a strong eye; (3) never allow seed pods to form on the bush. By these means you will encourage correct growth and freedom of bloom. There are odd varieties which resent the knife, Penelope for instance.

It is most inportant that plants be kept free from scale and other diseases, otherwise valuable portions have to be prematurely removed to the detriment of the plant. Exhibitors should prune harder than those growing for general purposes. Tea roses require lighter treatment than H.T.'s and H.P.'s.

To prune, cut away all dead, diseased, and spindling wood; thin out anything that is liable to crowd; cut back shoots to a strong eye, pointing outward in the case of uprights and inward on those of spreading habits; preserve any new strong shoots coming from the base (often misnamed water shoots) that may serve to replace any worn-out stems that should be renewed every three years or so.

As soon as the new growth appears, carefully rub off any shoot that is likely to overcrowd or grow in a wrong direction.

Climbers should be allowed their fling during the time they are establishing themselves. Train the strongest canes horizontally, about 24 inches apart, shorten the ends, and cut away all other wood. Provide for the renewal of these trailers every few years.

Aphis.—Nicotine sprays, such as Black Leaf Forty, are most effective. They may be kept in check by applying the hose freely.

Scale.—Spray with either red oil, kerosene emulsion, or any lime-sulphur mixture. Many roses are lost annually through scale.

Grubs, &c.—For all leaf, plant, and flower eating insects, spray with arsenate of lead as directed.

Mildew.—This is a stubborn fungus disease that has for many years past baffled our scientists. The rose, like all other life, no doubt requires a properly balanced food, and as analyses show that our soils are often deficient in potash and lime, it is not altogether surprising to find that, where good dressings of wood ashes have been applied, appreciable improvement in reducing the mildew scourge is apparent. Experiments are being conducted all over the world in search for a cure for mildew, and reports to hand show that potash used in its various forms gives results which are at least reassuring. For our part we can say that we have found the use of wood ashes, also spent carbide, beneficial. If these are not available, try giving each established tree say 4 to 6 oz. of sulphate of potash, in addition to lime, and observe the result.

Regular sprayings with liver of sulphur (1 oz. to 2 gallons of water), or 1 oz. bicarbonate of soda to 1 gallon of water, or Bordeaux, will ward off attacks. Remedies: Flowers of sulphur, 9 parts; arsenate of lead, 1 part; well mixed; applied with a bellows when the dew is on the foliage. Sprays: Sulphuric acid, 1 part to 800 parts of rain water, 1 oz. bicarbonate of soda to 1 gallon of rain water is a helpful spray. A drastic remedy is 2 tablespoonfuls of lysol to 1 gallon of water. Spraying should be done before noon. Always treat the underneath as well as the top of the foliage.

Failures.—Failures are generally attributable to one or more of the following causes:—

Having used fresh manures or fertiliser at time of planting. Allowing roots to be exposed after unwrapping. Lack of drainage or planting in soggy ground through excessive wet weather. Planting too near the edge of raised beds, too near shrubs, trees, and/or hedges; also in shady positions. Allowing plants to dry out after westerlies. Giving too much water during first fourteen days in cold weather. Heavy frosts just after planting or even when the plant is established. Planting too deep, planting too shallow, or planting too loose. Acidity in damp or poorly prepared soils. Chemical reactions from fertilizers previously applied to the soil. Plants being knocked by children or the thoughtless gardener. Dogs and cats are often the cause of plants dying or being damaged. The use of strong soap suds, &c. Planting too early or too late. Planting in same spot where a rose has been growing unless soil has been replaced.

TOMATO SEED SELECTION.

In selecting tomatoes from which seed is to be saved, only that from the best yielding plants which conform strictly to the characteristics of the variety, both as regards type of vine and type of fruit, should be chosen. Several fruit should be cut open to be sure of the quality. A plant should be chosen that produces a large number of average size tomatoes rather than a plant with two or three large fruits and a number of small ones. Care should be taken to see that the plant is free from disease, as several tomato diseases are transmitted by the seeds.

The best method of separating tomato seed from the surrounding pulp is as follows:—Cut the fruit in halves and scoop the contents into a bucket, and when the latter is about half full, fill up with water. Stand the bucket aside and allow the contents to ferment, which will take from two to six days, according to the warmth of the weather. A froth forms on top of the water when fermentation is sufficiently advanced. Wash the contents of the bucket on a fine sieve or a layer of hessian and the pulp will come right away from the seed, which must be spread out in a thin layer to dry. Rapid drying is important to prevent moulding. When dry, rub the seed in the hands to separate the individual seeds. Seed harvested in this manner has averaged 94 per cent. germination.

As already indicated, selection from a plant which is free from disease is important, but as a further precaution the seeds should be dipped for ten minutes in a solution of mercuric chloride, 1 part in 1,000 parts of water, before planting. Proper precautions must be taken with mercuric chloride where there are children or animals, as it is highly poisonous if taken internally.

Orchard Notes for July.

THE COASTAL DISTRICTS.

THE marketing of citrus fruits will continue to occupy the attention of growers. The same care in the handling, grading, and packing of the fruit that has been so strongly insisted upon in these monthly notes must be continued if satisfactory returns are to be expected. Despite the advice that has been given over and over again, some growers still fail to grasp the importance of placing their fruit on the market in the best possible condition, and persist in marketing it ungraded; good, blemished, and inferior fruit being met with in the same case. This, to say the least, is very bad business, and as some growers will not take the necessary trouble to grade and pack properly, there is only one thing to do, and that is to insist on the observance of standards of quality and see that the fruit offered for sale complies with the standards prescribed, and that cases are marked accordingly.

Where the crop has been gathered, the trees may be given such winter pruning as may be necessary, such as the removal of broken or diseased limbs or branches, and the pruning of any superfluous wood from the centre of the tree. Where gumming of any kind is seen it should be at once attended to. If at the collar of the tree and attacking the main roots, the earth should be removed from around the trunk and main roots—all diseased wood, bark, and roots should be cut away, and the whole of the exposed parts painted with Bordeaux paste.

When treated, do not fill in the soil around the main roots, but allow them to be exposed to the air for some time, as this tends to check any further gumming. When the gum is on the trunk or main limbs of the tree cut away all diseased bark and wood till a healthy growth is met with, and cover the wounds with Bordeaux paste.

If the main limbs are infested with scale insects or attacked by any kind of moss, lichen, or fungus growth, they should be sprayed with lime sulphur.

Towards the end of the month all young trees should be carefully examined for the presence of elephant beetles, which, in addition to eating the leaves and young bark, lay their eggs in the fork of the tree. When the young hatch out they eat their way through to the wood and then work between the wood and the bark, eventually ringbarking one or more of the main limbs, or even the trunk. A dressing of strong lime sulphur to the trunk and fork of the tree, if applied before the bettles lay their eggs, will act as a preventive. In the warmer localities a careful watch should also be kept for the first appearance of any sucking bugs, and to destroy any that may be found. If this is done systematically by all growers the damage done by this pest will be very much reduced.

Citrus trees may be planted throughout the month. Take care to see that the work is done in accordance with the instructions given in the June notes. All worn-out trees should be taken out, provided the root system is too far gone to be renovated; but when the root system is still good the top of the tree should be removed till sound, healthy wood is met with, and the portion left should be painted with a strong solution of lime sulphur. If this is done the tree will make a clean, healthy growth in spring.

The inclusion of a wide range of varieties in citrus orchards—and which has been the general practice—is to be deprecated. Even in new plantations there is a tendency to follow the same unprofitable lines. Far too much consideration is given to the vendor's description for the purchaser's appreciation of a particular variety or varieties. Individual tastes must be subordinated to market requirements, and the selection of varieties to the best available kind of early, medium, and late fruits. Amongst oranges Joppa should be placed first, Sabina for early fruit, and Valencia or Loon Giru Gong for late markets.

In mandarins local conditions influence several varieties, and since the introduction of the fungus known as "scab" the inclusion, particularly on volcanic soil, of the Glen Retreat and Emperor types is risky. In alluvial lands, Emperor and Sovereign (an improved Glen Retreat) are the most profitable, though Scarlet in many places is worth including, with King of Siam as a late fruit.

Land intended for bananas and pineapples may be got ready, and existing plantations should be kept in a well-cultivated condition so as to retain moisture in the soil.

Bananas intended for Southern markets may be allowed to become fully developed, but not coloured, as they carry well during the colder months of the year, unless they meet with a very cold spell when passing through the New England district of New South Wales.

The winter crop of smoothleaf pines will commence to ripen towards the end of the month, and when free from blackheart (the result of a cold winter) or from fruitlet core rot, they are good for canning, as they are of firm texture and stand handling. Where there is any danger of frost or even of cold winds, it pays to cover pines and also the bunches of bananas. Bush hay is used for the former and sacking for the latter.

Strawberries should be plentiful during the month, provided the weather is suitable to their development, but if there is an insufficient rainfall, then irrigation is required to produce a crop. Strawberries, like all other fruits, pay well for careful handling, grading, and packing; well-packed boxes always realising a much higher price than indifferently packed ones on the local market. Where strawberries show signs of leaf blight or mildew, spray with Bordeaux mixture for the former and with sulphide of soda for the latter.

When custard apples fail to ripen when gathered, try the effect of placing them in the banana-ripening rooms, and they will soon soften instead of turning black.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

JULY is a busy month for the growers of deciduous fruits, as the important work of winter pruning should, if possible, be completed before the end of the month, so as to give plenty of time for spraying and getting the orchard into proper trim before the spring growth starts.

In pruning, follow the advice given in the May number; and if you are not thoroughly conversant with the work, get the advice of one of the Departmental officers stationed in the district.

Pruning is one of the most important orchard operations, as the following and succeeding seasons' crops depend very largely on the manner in which it is carried out. It regulates the growth as well as the number and size of the fruit, as if too much bearing wood is left there is a chance of the tree setting many more fruits than it can properly mature, with a result that unless it is rigorously thinned out it is under-sized and unsaleable. On the other hand, it is not advisable to unduly reduce the quantity of bearing wood, or a small crop of overgrown fruit may be the result.

Apples, pears, and European varieties of plums produce their fruits on spurs that are formed on wood of two years' growth or more; apricots and Japanese plums on new growth and on spurs; but peaches and nectarines always on wood of the previous season's growth. Once peachwood has fruited it will not produce any more from the same season's wood, though it may develop spurs having a new growth or new laterals which will produce fruit.

The pruning of the peaches and nectarines, therefore, necessitates the leaving of sufficient new wood on the tree each season to carry a full crop, as well as the leaving of buds from which to grow new wood for the succeeding year's crop. In other words, one not only prunes for the immediately succeeding crop, but also for that of the following season.

All prunings should be gathered and burnt, as any disease that may be on the wood is thoroughly destroyed. When pruned, the trees are ready for their winter spraying with lime sulphur.

All kinds of deciduous trees may be planted during the month provided the ground is in a proper state to plant them. If not, it is better to delay planting until August, and carry out the necessary work in the interval. The preparation of new land for planting may be continued, although it is somewhat late in the season, as new land is always the better for being given a chance to mellow and sweeten before being planted. Do not prune vines yet on the Granite Belt; they can, however, be pruned on the Downs and in the western districts.

Trees of all kinds, including citrus, can also be planted in suitable situations on the Downs and western districts, and the pruning of deciduous trees should be concluded there. If the winter has been very dry, and the soil is badly in need of moisture, all orchards in the western districts, after being pruned and ploughed, should receive a thorough irrigation (where water is available) about the end of the month, so as to provide moisture for the use of the trees when they start growth. Irrigation should be followed by a thorough cultivation of the land to conserve the water so applied. As frequently mentioned in these notes, irrigation and cultivation must go hand in hand if the best results are to be obtained, especially in our hot and dry districts.

Farm Notes for July.

FIELD.—Practically the whole of the work on the land for this month will be confined to the cultivation of winter crops, which should be now making good growth, and to the preparation of land for the large variety of crops which can be sown next month. Early-maturing varieties of wheat may be sown this month. The harvesting of late-sown maize will be nearing completion, and all old stalks should be ploughed in and allowed to rot. Clean up all headlands of weeds and rubbish, and for this purpose nothing equals a good fire. Mangels, swedes, and other root crops should be now well away, and should be ready for thinning out. Frosts, which can be expected almost for a certainty this month, will do much towards ridding the land of insect pests and checking weed growth. Cotton-picking should be now practically finished and the land under preparation for the next crop. The young lucerne should be becoming well established; the first cutting should be made before the plants flower—in fact, as soon as they are strong enough to stand the mowing machine—and the cutting of subsequent crops should be as frequent as the growth and development of the lucerne plants permit. Ordinarily cutting should be regulated to fit in with the early-flowering period—i.e., when about one-third of the plants in the crop are in flower.

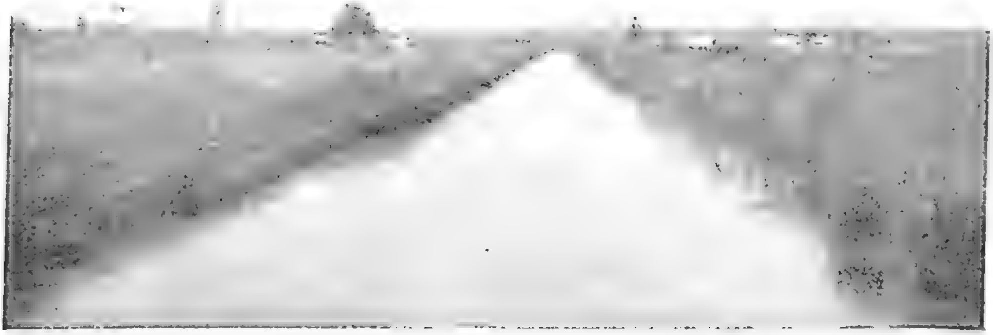


PLATE 171.
A main channel, Theodore Irrigation Settlement, Queensland.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

Table showing the Average Rainfall for the Month of April, in the Agricultural Districts, together with Total Rainfall during April, 1934, and 1933, for Comparison.

Divisions and Stations.	Average Rainfall. Apr.	Average Rainfall. No. of Years' Records.	Total Rainfall. Apr., 1934.	Total Rainfall. Apr., 1933.
North Coast.	In.		In.	In.
Atherton	4·29	33	6·05	11·35
Cairns	11·52	52	13·38	18·63
Cardwell	8·87	62	11·16	9·09
Cooktown	8·75	58	12·86	16·86
Herberton	3·89	48	4·39	6·98
Ingham	7·82	42	4·19	3·01
Innisfail	19·94	53	39·35	24·19
Mossman Mill ..	8·77	21	4·42	22·19
Townsville	3·47	63	1·69	5·61
Central Coast.				
Ayr	2·56	47	1·03	2·76
Bowen	2·78	63	0·81	2·74
Charters Towers ..	1·54	52	1·09	0·55
Mackay	6·37	63	3·02	4·61
Proserpine	5·90	31	4·39	5·95
St. Lawrence ..	2·85	63	2·05	1·97
South Coast.				
Biggenden	2·19	35	4·55	3·69
Bundaberg	3·12	51	11·91	5·83
Brisbane	3·86	83	6·33	8·95
Caboolture	4·41	47	16·19	8·85
Childers	2·85	39	6·13	3·50
Crohamhurst.. ..	6·74	41	15·90	12·61
Esk	3·10	47	3·91	4·98
Gayndah	1·48	63	2·05	2·92
Gympie	3·43	64	9·07	3·47
Kilkivan	2·28	55	4·94	2·42
Maryborough ..	3·78	63	10·12	3·65
Nambour	6·30	38	10·62	11·98
Nanango	1·98	52	3·67	2·24
Rockhampton ..	2·61	63	3·00	1·57
Woodford	4·71	47	9·32	14·32

Divisions and Stations.	Average Rainfall. Apr.	Average Rainfall. No. of Years' Records.	Total Rainfall. Apr., 1934.	Total Rainfall. Apr., 1933.
Central Highlands.	In.		In.	In.
Clermont	1·65	63	0·68	1·88
Gindie	1·25	35	0·14	2·90
Springsure	1·59	65	1·75	0·78
Darling Downs.				
Dalby	1·40	64	3·33	1·24
Emu Vale	1·39	38	3·90	2·00
Hermitage	1·46	28	2·72	1·82
Jimbour	1·38	46	3·58	1·07
Miles	1·49	49	2·42	1·87
Stanthorpe	1·76	61	4·69	1·57
Toowoomba ..	2·60	62	6·28	3·68
Warwick	1·67	69	2·36	1·81
Maranoa.				
Roma	1·35	60	0·78	0·89
State Farms, &c.				
Bungeworgorai ..	1·28	20	0·72	1·15
Gatton College ..	1·89	35	..	1·91
Kairi	4·11	20	..	10·74
Mackay Sugar Experiment Station	4·95	37	2·57	4·40

GEORGE G. BOND, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—APRIL, 1934.

Compiled from Telegraphic Reports.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature. Means. Max.	Means. Min.	Extremes. Max.	Date.	Min.	Date.	Rainfall. Total.	Wet Days.
Coastal.	In.	Deg.		Deg.		Deg.		Points.	
Cooktown	29·82	85	73	89	9	69	5	1,286	14
Herberton	..	76	61	84	6	53	16	439	15
Rockhampton	29·97	83	66	90	16	55	24	300	11
Brisbane	30·05	78	62	86	19	50	24	633	16
Darling Downs.									
Dalby	30·03	79	54	89	18	36	24	333	8
Stanthorpe	..	70	49	81	8	21	24	469	11
Toowoomba	..	72	53	82	19	33	24	628	14
Mid-interior.									
Georgetown	29·85	90	66	97	2	56	15, 16	90	6
Longreach	29·96	89	62	97	6,7,8	50	23, 25	115	2
Mitchell	30·03	81	52	91	18	33	24, 25	36	3
Western.									
Burketown	29·86	93	72	102	8	64	27	53	2
Boulia	29·96	88	63	100	6, 7	47	25	15	1
Thargomindah	30·03	80	59	93	5	42	29	86	2

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	June, 1934.		July, 1934.		MOONRISE. June, 1934.	MOONRISE. July, 1934.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	6·37	5·2	6·45	5·7	8·33	9·38
2	6·37	5·2	6·45	5·7	9·42	10·40
3	6·38	5·2	6·45	5·7	10·47	11·41
4	6·38	5·2	6·45	5·8	11·49	a.m.
5	6·39	5·2	6·45	5·8	a.m.	12·40
6	6·39	5·2	6·45	5·8	12·51	1·40
7	6·39	5·2	6·45	5·9	1·49	2·39
8	6·40	5·2	6·45	5·9	2·47	3·36
9	6·40	5·3	6·44	5·9	3·48	4·31
10	6·40	5·3	6·44	5·10	4·47	5·24
11	6·40	5·3	6·44	5·10	5·43	6·12
12	6·40	5·3	6·44	5·10	6·38	6·57
13	6·41	5·3	6·44	5·11	7·30	7 35
14	6·41	5·3	6·44	5·11	8·18	8·9
15	6·41	5·3	6·44	5·12	9·1	8·39
16	6·41	5·3	6·43	5·12	9·37	9·10
17	6·42	5·4	6·43	5·13	10·10	9·35
18	6·42	5·4	6·43	5·13	10·39	10·5
19	6·42	5·4	6·42	5·14	11·8	10·36
20	6·42	5·4	6·42	5·14	11·37	11·8
					p.m.	
21	6·43	5·4	6·41	5·15	12·8	11·47
						p.m.
22	6·43	5·4	6·41	5·15	12·40	12·34
23	6·43	5·4	6·40	5·16	1·16	1·30
24	6·44	5·4	6·40	5·16	1·58	2·35
25	6·44	5·5	6·39	5·17	2·51	3·44
26	6·44	5·5	6·39	5·17	3·54	4·55
27	6·44	5·5	6·38	5·18	5·2	6·9
28	6·44	5·5	6·38	5·18	6·12	7·18
29	6.44	5.6	6·37	5·19	7·24	8·24
30	6·44	5·6	6·37	5·19	8·31	9·27
31	..	..	6·36	5·20	..	10·29

Phases of the Moon, Occultations, &c.

4 June	☽ Last Quarter	10 53 p.m.
12 ,,	● New Moon	12 11 p.m.
20 ,,	☾ First Quarter	4 37 p.m.
27 ,,	○ Full Moon	3 8 p.m.

Apogee, 15th June, at 8.18 p.m.
Perigee, 28th June, at 10.54 a.m.

Venus, not nearly so brilliant as in January, will be conspicuous near the border of Pisces and Aries.

In the early mornings of the first three or four days of June the apparent nearness of Venus and Uranus, separated by little more than three diameters of the Moon on the 2nd, will form an interesting object for observers with telescopes.

Saturn, near the border of Capricornus and Aquarius, will be only 3 degrees south of the Moon when it rises at 10.47 p.m. on the 3rd.

Always an interesting object in a telescope, it will be coming into view late at night, rising at 10.49 p.m. on the 1st and at 9.54 p.m. on the 15th. Its unique ring-system has been closing in for the last six years, so that it will be far from at its best; but about one-third of its northern side may still be seen.

The Moon will be passing from west to east of Mars at 9 p.m. on the 11th, but the Sun, being only 14 degrees further east, and there being an interval of only 27 hours till new Moon, no observations will be generally practicable.

Jupiter, in Virgo, which had seemed to be moving westward since 20th February, will become stationary on 11th June, and afterwards continue its normal eastward direction till the end of the year. It will be the principal evening star during the month, remaining almost in the same spot in Virgo.

Mercury will reach its greatest elongation, 24 degrees east of the Sun on the 14th, and remain above the horizon for about one hour and three-quarters after sunset, being then very near the place in Gemini where Pluto was discovered four and a-half years ago, in the neighbourhood of Delta Geminorum, a star of magnitude 3½. Observers will find this an easy and interesting object. At 5 o'clock in the afternoon of the 14th the crescent-shaped Moon will be only one degree north of Mercury.

On the 22nd Jupiter will be passed by the Moon at 2 a.m.; the planet then being 7 degrees (one degree more than the length of the Cross) north of it.

An interesting occultation of Antares, the principal star of Scorpio, should be looked for about 9 p.m. on the 25th, when the Moon and the star will be very nearly overhead at Brisbane, Toowoomba, and Warwick.

4 July.	☽ Last Quarter	6 28 a.m.
12 ,,	● New Moon	3 6 a.m.
20 ,,	☾ First Quarter	4 53 a.m.
26 ,,	○ Full Moon	10 9 p.m.

Apogee, 13th July at 4.12 a.m.
Perigee, 26th July at 8.18 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

Supplement to the "Queensland Agricultural Journal," October, 1934.

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By Authority: DAVID WHYTE, Government Printer, Brisbane.

VOLUME XLII

QUEENSLAND AGRICULTURAL JOURNAL

Issued by direction of

The Hon. the Secretary for Agriculture

Edited by J. F. F. REID

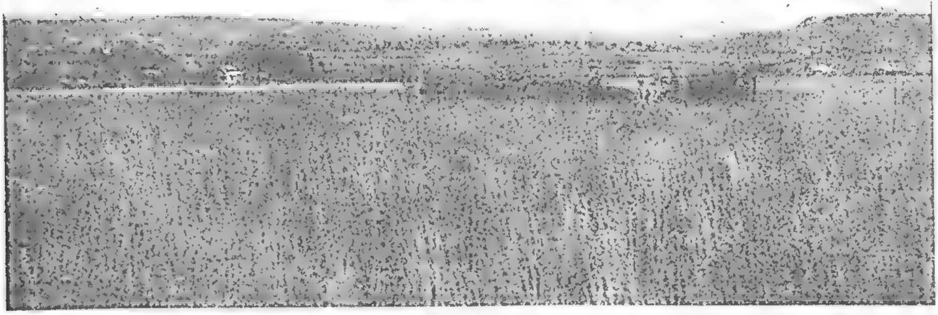
JULY to DECEMBER, 1934

By Authority: DAVID WHYTE, Government Printer; Brisbane.

ANNUAL RATES OF SUBSCRIPTION.

Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling.** Members of Agricultural Societies, **Five Shillings**, including postage. General Public, **Ten Shillings**, including postage.

QUEENSLAND AGRICULTURAL JOURNAL



VOL. XLII. 1 JULY, 1934. PART 1.

Event and Comment.

The Tobacco Industry in the North.

REFERRING to a proposal that the State Government should take over the Tobacco Experiment Farm at Mareeba, which was established some years ago by the Commonwealth Government, which is now abandoning the project, the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, informed the Press recently that he could not agree to such a proposal. The Commonwealth Experiment Farm at Mareeba had, no doubt, fulfilled its purpose up to a point. The Commonwealth Government, however, had not given his Department any details of its work, results, or policy at Mareeba. He had no figures indicating its cost of upkeep, nor had any other essential information been made available to his Department. In the circumstances, Mr. Bulcock said, to take over the farm would be literally buying "a pig in a poke." Moreover, if acquired, the expense of its maintenance would lead inevitably to a limitation of the more practical and diversified form of research already instituted by the Department of Agriculture, and which alone could produce the detailed knowledge of soil, climatic, and other conditions affecting the tobacco crop, and of which growers were in urgent need.

Far from neglecting the tobacco industry in the North, the Minister added, the Government had considerably strengthened its instructional staff in that division at the expense of other agricultural industries. At the present time there were altogether five field officers at Mareeba and Dimbulah, engaged solely on instructional and experimentation work associated with the tobacco-growing industry. In addition, the services of local officers of the Entomological and Pathological staff had been made available to the tobacco growers in those districts. The extension of the work of his Department along the lines already planned would yield information of greater value to the tobacco growers generally than could be expected from a continuance by the State of the Federal Tobacco Experiment Farm at Mareeba.

Experiment Plot System Organised.

PAST experience with tobacco and other agricultural crops, continued Mr. Bulcock, had shown that experiment work, as distinct from purely research work, to be of the maximum practical value to growers as a whole must be designed to embrace all of the soil types and variations of climate and locality associated with production of commercial crops. For that reason, his Department had adopted a policy of replacing experiment farms with a well-organised system of experiment plots throughout a particular district. In the last two years most of the money available for agricultural experiment had been applied, almost exclusively, to the development and extension of the tobacco experiment plots for the purpose of assisting the grower in the most practical way. Previously that work had been confined to a few small, scattered, exploratory plots varying in area from a quarter of an acre to an acre, and situated in widely separated parts of the State. Tobacco experiment work in the far North was limited to one locality alone—Mareeba. Under the present Government sixty local experiment plots had been established with a range of trials covering plant classification, propagation, crop rotation, and fertilization, as well as varietal tests. Of that number thirty-nine were situated in the far North, including twenty-two in the Cairns district. From these more up-to-date methods, information of immense practical value to growers, had been made available in every locality so served.

The additional Commonwealth grant of £1,250, which it had been claimed should be used by the State for carrying on the Mareeba Tobacco Farm, and which would otherwise permit of an extension of the more practical Departmental scheme, was not given for investigatory work in one particular locality, but in the State as a whole. To curtail the practical field work of his Department, which was of benefit to every grower in the North, as well as in other parts of the State, merely to enable a purely local experiment station to be carried on, could not be justified on the facts, financial or otherwise. Having regard for the wide variation in soil types and every other controlling factor, the continuance of such a station could only benefit a few local growers farming country similar to that on which the station was established. In any case, equally valuable information could be gained by the more practical plot system by all the growers concerned, including, of course, those farming in the immediate vicinity of the station.

The General Position of the Tobacco Industry.

MR. BULCOCK added that he was deeply concerned with the position of the tobacco growers in the North, as well as in other parts of the State. Everything that could be done by the State Government would be done to relieve the situation. Regarding the position of the tobacco industry generally, the present unsatisfactory position must be attributed largely to the reduction of duty on imported leaf and the increase in excise on home-grown leaf. In this respect North Queensland growers were not alone in their feeling of the effects of the present Federal fiscal policy.

In respect to the marketing of Mareeba leaf particularly, there had, apparently, been no fixed standards of buying, and the buyers had shown surprising inconsistency in their purchases. No definite information had, seemingly, been received by the growers from the manufacturers as to grades, quality, and quantity of leaf necessary to meet manufacturing requirements.

The fact remained, concluded Mr. Bulcock, that while a considerable quantity of usable Australian was left unsold—the best of it in some cases not even attracting a bid—the volume of imports showed little diminution. Up to approximately 17,000,000 lb. of foreign-grown leaf was imported into Australia last year. As the Australian consumption was about 20,000,000 lb., the margin in favour of the Australian producer was lamentably small.

Heavy Cane Crop in Prospect.

IN his preliminary estimate of the Queensland cane crop the director of the Bureau of Sugar Experiment Stations (Dr. H. W. Kerr) says the yield this year will be 4,516,000 tons of cane, as compared with the record tonnage of 1933, when 4,667,000 tons of cane were milled. Heavy tonnages of cane will be harvested in most mill areas again this year. The beneficial rains experienced in the Southern districts during the past growing season have resulted in the production of the heaviest crops recorded in those parts during the past ten years.

It is probable that the early forecast will be reduced considerably before the harvest is completed, due to the extraordinarily heavy flowering which is being experienced in all districts, he adds. Where the canes have "arrowed," no further growth will take place, and there is a possibility that much of the crop will be overmature before it is harvested. Early reports from those mills which have commenced crushing, and preliminary tests from other areas where harvesting has not yet begun, suggest that the cane is this year rich in sugar, in contrast to that of 1933. Allowing 7·1 tons of cane to produce 1 ton of sugar, the sugar yield on the above estimates will be 636,000 tons, as compared with an actual yield of 638,000 tons for 1933.

Farm Training Schools.

THREE farm training schools on similar lines to the establishment at St. Lucia, near Brisbane, may be opened in country districts in the near future. In making this announcement recently, the Minister for Agriculture and Stock (Hon. Frank W. Bulcock) added that it had been decided to make an inquiry as to suitable sites and that the investigation would cover the Central and Northern Divisions of the State; and that it was probable that a farm training school would be established at Kairi Experiment Farm on the Atherton Tableland.

Queensland Citrus Scale Insects and their Control.

By W. A. T. SUMMERVILLE, M.Sc., Assistant Entomologist.

(Continued from page 591, Volume XLI.)

SCALICIDES.

INSECTICIDES are classified, in accordance with the manner in which they affect the insect, in three groups—stomach poisons, fumigants, and contact insecticides.

As scale insects draw their food supply from beneath the surface of the plant the only method of administering a stomach poison would be by introducing it into the sap of the plant. Experiments with this object in view have been carried out in various countries, and in the course of the work on scale insects of citrus in Queensland a number of substances claimed to be effective in this way were tested. However, no success has so far been achieved here, and from the reaction of the plant to those substances which have been tried there does not appear to be much hope of success in obtaining a general distribution of any chemical throughout the plant by injecting it into any one part. From observations on the apparent resistance of particular trees to certain species of scale insects it appears possible, however, that if the correct material could be found and the plant made to absorb it in the same way as it ordinarily does its food, the sap might be rendered unsuitable for certain scale insects. This is mere theory, however, and as there is no known way of effectively polluting or altering the sap of citrus, the artificial control of scale insects must be accomplished by the use of fumigants and contact insecticides.

FUMIGANTS.

The only fumigant discussed in the control of citrus scale insects will be hydrocyanic acid gas, which can be produced in a number of different ways in the orchard.

Hydrocyanic Acid.

Since Coquillett, who was investigating the control of cottony cushion scale in California at the time, demonstrated the value of hydrocyanic acid gas as a scalicide and placed its use on a practical basis, this material has become more and more commonly used for such a purpose in many parts of the world, and is generally regarded as the most dependable lethal agent known for the control of insect pests. The acid and many of its derivatives are extremely poisonous, not only to most insects but to higher animals, and great care must be exercised in handling these substances to which the general name "cyanide" is applied. The fumigant has no significant ill effects on the tree provided certain conditions are observed, but if the limit of these conditions be exceeded the trees may be severely injured. In so far as orchardists are concerned there are two important physical properties of the gas. It is colourless, and its presence can therefore be detected only by the smell, which resembles that of bitter almonds, and it is lighter than air and therefore tends to rise and diffuses rapidly in ordinary atmospheres. The gas may be produced in the orchard by the reaction of

sulphuric acid or water on a derivative of hydrocyanic acid, or by the volatilization of liquified acid. These methods will be discussed separately under the headings of the chemical chiefly concerned.

Potassium Cyanide.

For many years all the hydrocyanic acid gas used in fumigating citrus trees was produced by the so-called "pot" system. This method has been largely displaced by other more convenient ones, but it is still used to a considerable extent in Queensland, and owing to increasing costs of the more recently introduced methods there are indications that the old "pot" method may again become the most commonly used.

With this method the required amount of water is placed in an earthenware jar and good commercial sulphuric acid, equivalent in volume to one-third of the water, is added. The jar is then placed in position under the sheet (see procedure lower down) and the required amount of potassium cyanide is dropped quickly into the jar. If the jar be shallow a piece of sacking placed over the mouth is useful to prevent spurting. The required amounts of chemicals are determined by reference to a table prepared for the purpose. (See Table II., page 22.) It is important that the correct amount of water be used. In all cases the proportion of water, acid, and cyanide is 3:1:1, where the amount of cyanide is expressed in ounces avoirdupois and the liquids in fluid ounces. If too little water be used the reaction may not go to completion, and if too much be present the amount of available gas is again reduced. If pure sulphuric acid be used the product may contain an appreciable amount of another gas which is very injurious to plants. In practice the potassium cyanide used is not pure, but is a mixture of potassium and sodium cyanide and a little inert matter. Generally a value of the article in terms of its equivalent to pure potassium cyanide is declared.

This method has a number of objectionable features. From the point of view of those doing the work it is both cumbersome and dangerous. The work must be done at night, and measuring the highly-corrosive sulphuric acid and handling the very poisonous potassium cyanide is very unpleasant work. From the point of view of the grower there is the extra cost of night work, the increased depreciation of equipment, and the lack of continuity of work commonly experienced on account of unsuitable atmospheric conditions.

The efficiency of hydrocyanic acid gas as a scalicide was shown by Knight[9] to be dependent on both the concentration and the length of time the insects are enveloped. That is to say, the smaller the amount of gas the longer it will need to remain to kill the insect. There is a definite minimum below which the gas is not lethal no matter how long it be present, and the upper limit of concentration is dictated by the reaction of the tree to the poison. When generated by the "pot" method the gas is hot and is evolved quickly, and thus diffusion is very rapid. In practice very rapid diffusion means rapid leakage, and thus concentration of the fumigant may be so quickly lowered that there is a considerable drop in efficiency. For this reason the "pot" method is not the most satisfactory way of producing the fumigant. An exception, however, appears to be provided in the case of pink wax, and the "pot" method has been found normally to give better results against

this species than the other systems in which the fumigant is evolved more slowly. It would seem that with pink wax the time factor is of less importance than with most other citrus scale insects.

Calcium Cyanide.

Fumigation by the use of calcium cyanide is the most commonly used method in Queensland at the present time. When calcium cyanide interacts with water hydrocyanic acid gas is produced. In citrus fumigation practice the calcium cyanide in a finely-divided state is brought into contact with the water vapour of the atmosphere. The rate at which the gas is evolved depends on the amount of water vapour present and the rate at which this can come in contact with the active material. The rate at which the water vapour can reach the material depends to a large extent on the surface area of the solid, and thus this rate will be increased as the size of the particles of the solid is diminished. The state of division of the material is therefore of importance. There are a number of forms of calcium cyanide marketed in Queensland, but only two proprietary lines are used to any extent in citrus fumigation. These are Cyanogas and Calcid Briquettes.

Cyanogas for citrus fumigation is manufactured in two forms—"A" Dust and Cyanogas G. The former is a finely-powdered material and the latter more granular. In theory the G grade should be the safer and better form for citrus fumigation, but growers generally prefer the "A" Dust. Provided attention is given to conditions the "A" Dust is perfectly satisfactory under Queensland conditions, and the only injury noted after extensive use of this material has been burning of lemon fruits when a good distribution of the dust was not obtained.

Calcid Briquettes represent a more recent method of citrus fumigation. This method has not yet been adopted to any great extent in this State, but it has much to commend it. In fact, in experimental fumigation work the best results obtained against all species of scales other than pink wax were obtained with this material.

In using calcium cyanide in either of the above forms, all that is necessary is to introduce the material under the tent and obtain as good a distribution as possible. In the case of Cyanogas the most commonly used method is to blow the dust under with a forge type blower, but owing to the cost of such a blower many growers throw the dust in by hand. The dust is placed in a shallow tray, such as a saucer, and thrown in with a sweeping motion. This is effective, but precautions must be taken to obtain a good distribution of the dust. If the dust be merely thrown in and allowed to fall in heaps, the risk of burning is considerable, and at the same time the probability of effective fumigation of the scale insects is appreciably lessened. The use of a blower is strongly recommended, but the hand method may be used provided the necessary care be taken. In the case of Calcid Briquettes it is essential to use a grinding machine, and for this purpose a specially-designed machine is obtainable. This grinds the briquettes finely and delivers the powder under the tent.

The methods of obtaining hydrocyanic gas by the use of calcium cyanide have much to commend them. No corrosive acid is employed; calcium cyanide, though poisonous, is much safer to handle than potassium cyanide; the work can be carried out in daylight under a

wide range of climatic conditions; and the whole operation is very simple. The manner of evolution of the gas is such that the leakage factor is definitely reduced, and in no case observed has severe burning been caused when correct precautions were taken. The results obtained against all species of scale are highly satisfactory, and, except in the case of pink wax, are superior to those obtained with the "pot" system.

Liquid Hydrocyanic Acid.

Since 1918 the use of liquid hydrocyanic acid has largely displaced all other methods in California. The liquified acid is drawn to a machine known as an applicator. This machine measures the dose and delivers the liquid under the tent through an atomising nozzle. On reaching the air the atomised liquid is immediately converted to the gaseous state. This method eliminates most of the objectionable features of the old "pot" system, both from the point of view of actual work and efficiency as a scalicide. Liquid hydrocyanic acid, however, has not yet been introduced into this State, and under present circumstances its introduction would scarcely be a commercial success. If, however, the difficulties of marketing it at a reasonable cost could be overcome, the liquid would almost certainly be the most satisfactory form in which to use the fumigant.

Possible Fumigation Injury.

Fumigation injury, or, as it is commonly termed by growers, "cyanide burn," is fairly distinctive in type but is occasionally mistaken for fungous trouble. Leaves may be merely spotted, or, particularly if tender, have an appearance very similar to frost burn. The injury to the twigs is similar. The trunk and main limbs are seldom damaged, but patches of dark dead bark sometimes appear when careless application causes calcium cyanide dust to lodge in a heap on the tree as it sometimes does in a fork. Such injury to woody parts is commonly followed by gumming. When the "pot" method is used, emptying vessels close to the butt of the tree may cause the death of bark and roots nearby.

On the fruit, fumigation injury is somewhat variable. The most common type is a pitting of the rind. These pits may surround a patch of dead tissue which imparts a scab-like appearance to the area. At other times, especially in the case of lemons, on the upper portions of the fruit, particularly those in contact with the sheet, there may be a brown or light-green area, which, if the fruit remain on the tree, turns to a somewhat bronze colour.

Badly injured leaves and fruit fall quickly, and very small fruits rarely survive the slightest injury. In cases of severe burning twigs may be killed back to the limit of hardened growth, whilst in the worst cases the dead tissue may extend a foot or more back from the tips.

CONTACT INSECTICIDES.

The following contact insecticides will be discussed in the succeeding paragraphs:—Oil sprays, lime sulphur, washing soda wash, soap and washing soda mixture, oil-soap-washing soda spray, and resin-soda-fish oil spray.

Oil Sprays.

The occurrence of varieties and species of scale insects resistant to hydrocyanic acid gas greatly stimulated research work on oil sprays in

the United States of America. As the result of the investigations carried out by de Ong,[10] Ralph H. Smith,[11] Woglum,[6] and others, there is now a fuller conception of the manner in which oil sprays act and a far better understanding of the essential properties of an effective and safe oil spray.

Kerosene emulsion may be regarded as the forerunner of the present day oil sprays. This material fulfilled one requirement in that it was reasonably effective. The emulsion, however, is rather difficult to prepare and gives very little margin of safety to the trees, and was displaced by the miscible oils.

Miscible oils are refined petroleum oils in which is dissolved a soap or some other such substance which enables the oil to be readily mixed with water to produce a stable emulsion. These miscible oils have been in use for a considerable period.

Following miscible oils another type of oil spray known as oil emulsion was produced. These oil emulsions are prepared by dissolving an emulsifier such as calcium or ammonium caseinate in water and adding the oil. When violently agitated the mixture breaks up into small globules and forms a stable emulsion.

In California a third type of oil spray is finding much favour and is now generally recommended. This is the so-called tank-mixture type. The pure oil is added to the water in the spray tank and an emulsifier, commonly powdered blood albumen spreader, is stirred in, and the whole then violently agitated. The agitation is a most important part of the preparation and must be maintained throughout the spraying. The greatest advantage of the tank-mixture spray is that growers are thus enabled to prepare an oil spray of known and definite properties. In practice two grades of oil are supplied, a light oil and a heavy one. By mixing these in various proportions a number of different grades may be produced in accordance with the requirements of the trees to be sprayed. The greatest drawback to this type of oil spray in so far as Queensland at present is concerned is that machines capable of moving a large-sized agitator at 200 revolutions per minute do not form part of the spraying outfit of any orchardist, and most machines in use would have to be discarded since that agitation is essential. This, however, would not prove an insuperable barrier in many cases, but the proprietary brands of oil sprays now available are for the most part so satisfactory that tank-mixture oils are not likely to be used to any extent in this State under present circumstances.

The greatest practical result of the research work mentioned above, in so far as Queensland is concerned, has been the production of the so-called white oils. These white oils represent a distinct advance on the old red miscible oils. The improvement is not so much in increased toxicity to the scale insect, for though some white oils are superior to any red oil certain red oils are definitely superior to many white ones in respect to toxic effect on the scale insect. The great advantage of the white oils is the increase in the safety of the trees, and in this particular the difference between the two is great, and much of the objection to the use of oils on citrus disappears when white oils are used.

The scalicidal value of an oil depends on both the efficiency of the material as a lethal agent on the pest and on its effects on the tree. These properties are governed largely by the purity of the oil, the

volatility of the oil, that is, the rate at which it will dry and evaporate, and the amount of the oil left on the tree after spraying. The purity of the oil depends on the extent to which unsaturated hydrocarbons are present. These unsaturated compounds, which are very poisonous to the plants, are removed from the crude oil by the use of sulphuric acid, and the purity of the oil is expressed in terms of the percentage which remains unchanged when treated with sulphuric acid. By modern processes oils can be highly refined without undue increase in cost, and this represents one of the most important advances made with respect to oil sprays. An oil, to be quite safe as a spray material under most conditions in Queensland, must be about 90 per cent. pure. Most of the white spraying oils marketed in Queensland fulfil this requirement. There are, however, a small number which are appreciably less purified, and though these may be employed under certain circumstances care must be taken to observe the conditions of use. Generally it has been found that the less pure oils must be used at considerably lower temperatures than would be quite safe for those fulfilling the condition given above.

The more volatile an oil the quicker it will evaporate, and as oils must remain on the insect for a certain length of time to cause death, too light an oil cannot be used for scalicidal purposes. However, when an oil spray remains on the plant it penetrates the tissues to some extent, and the longer it remains, within certain limits, the more oil there will be absorbed by the plant. A little oil may be absorbed without appreciable ill effect, and the more vigorous the plant the greater the amount which may be absorbed without prejudice to the health of the plant. In larger quantities, however, the absorbed oil may cause death to the part. Thus, though to effect a kill of the scale insect an oil must not be too light, it must not be so heavy that the plant is adversely affected. Under Queensland conditions the use of heavy-weight oils is fraught with danger.

When an oil spray lodges on the tree the emulsion is broken down and the oil and water separate. The rate at which this separation takes place depends to a large extent on the efficiency of the emulsifier. If the quantity of spray which falls on a leaf is not more than actually required to wet it, all the oil in that amount of spray will, of course, remain on the leaf. In actual spraying, however, in order to ensure that every part of the tree is covered, much of the tree will receive a great deal more spray than is actually necessary to wet it. As soon as, say a leaf, it wetted any further spray lodging on it will commence to run off. It has been shown experimentally that when free oil comes in contact with a wetted surface it does not necessarily run off but may build on the oil already deposited. Thus, when the spray lodges on the wetted leaf, if the emulsion breaks quickly some of the oil will remain to build up, and the run off will contain less oil than would be the case were the emulsion to break slowly. As the amount of oil deposited on the tree directly affects the scalicidal value, the quicker breaking the emulsion the greater the efficiency of the spray against the insect. It is, of course, possible to have a too quick breaking emulison, for the more oil there is left the more there will be absorbed into the tree. In practice, however, quick-breaking emulsions are necessary, and emulsifiers which satisfy in both particulars are generally used. The emulsifier also influences the spreading qualities of the spray, and in this again is an important component of any oil spray. For

reasons which are apparent from what has been stated above, the better the spreading quality the quicker breaking the emulsion required. It may be said then that, to a large extent, the lethal value of an oil spray increases as the margin of safety to the tree decreases, and as all oil sprays are chemically very similar the difference in brands is caused, to a very large extent, by the methods and substances used in effecting a compromise between the two. In so far as the brands of white oils marketed in Queensland are concerned it may be said that the safety of the tree has apparently been fully considered, and further that with those brands used at all extensively there has been little loss in insecticidal efficiency to bring about this result. In purchasing any of the brands of white oil at present sold extensively in the State, growers will obtain quite satisfactory spray material. Other brands, however, will no doubt appear, and growers should protect themselves by obtaining information on the essential properties as outlined above before purchasing.

The following are the data concerning two typical oil sprays of good quality:—

White Oil—

Unsulphonated Residue, 95 per cent.

Viscosity (Redwood) 1 at 100°F., 60-70 seconds.

Red Oil—

Unsulphonated Residue, 75 per cent. to 80 per cent.

Viscosity (Redwood) 1 at 100°F., 155 seconds.

It is essential that oil be applied to the trees well emulsified with water. Whilst growers almost always attend to the production of such an emulsion before the application commences, too often inefficient agitation is given whilst the spraying is in progress. The number of spraying outfits in the State which have either a very poor agitator or none at all in the vat is remarkably high. The ill effects of an oil spray are magnified by such a state of affairs, and the provision of good agitators must be treated as an urgent necessity.

Possible Ill Effects of Oil Sprays.

As has been stated above the white oils are very much less harmful to citrus trees than are the red. This, however, cannot be taken to mean that white oils are wholly beneficial to the trees. However, if used correctly these white oils are very useful sprays and can be recommended for the control of several species of scale insects. There is, however, much needless use of oil sprays in Queensland. Too often oil is used in the hope that it will control a pest. The attitude which should be taken is to use oils only when it is known that these will be successful. There is no doubt that a great many of the trees in Queensland which have never or rarely been sprayed with oil are superior in general condition to comparable trees which are regularly so treated. This refers to general effects, which may perhaps be termed cumulative.

Possible direct ill effects are varied. Generally, however, they are the result of failure to observe the conditions laid down with respect to oil spraying in general. Probably there is some little direct damage every time an oil is sprayed onto a citrus tree, but if precautions be taken these ill effects can be reduced to insignificance. Almost any part of the tree may be adversely affected. Roots and the base of the

trunk are sometimes damaged by allowing an accumulation of oil to remain in contact with them after it has run down the trunk. The damage is most severe in the case of young trees, and with such it is wise to hill the soil up round the base of the trunk before application and to remove the mound shortly afterwards. Leaves, twigs, and fruit may be severely injured, and dropping of portion of the crop, particularly when the fruit is small, is possible. Partial or total defoliation of the tree may also be caused by the injudicious use of an oil, and in such cases a large proportion of the twigs may be killed back 6 inches or more. Less severely damaged leaves and fruit may remain on the tree, and these are usually spotted with brown markings or pitted, and the fruit thus rendered unsightly and depreciated in market value. Crop reduction may be caused in several ways, such as by the reduction of blossoming, or by the dropping of young fruit, and through the general health of the tree being impaired and the size and number of fruit being thus reduced. Retardation in colouring, both on the tree and in the colouring chamber, may also be caused by oil sprays. For this reason it is advisable to pick lemons immediately before spraying.

Trees in poor condition are much less able to withstand the ill effects of oil sprays than healthy ones, and allowance must always be made for that fact. A tree suffering from lack of water should never be sprayed with oil. As oils penetrate the plant it is obvious that the oil sprayed in the winter will affect the plant more than if applied during a period of free growth. Oils therefore should not be applied to citrus trees during a dormant period. Trees sprayed with oil during the winter have been kept under observation, and in some cases no great direct ill effect has been noted at the time. In every case, however, the oil has had some appreciable ill effect. Lighter blossoming, weakening of fruit-bearing wood, and premature heavy leaf fall are almost always to be noted. In other cases both direct and indirect effects have been observed. The maximum temperature at which a white oil should be used is about 100°F. At this temperature healthy trees not lacking water may be sprayed safely. However, it is recommended that oil spraying should be carried out in as cool weather as possible, taking into consideration the essential points concerning the pest being combated.

Growers should follow closely the directions given by the manufacturer of an oil. These include provision for maintaining an emulsion. Growers often complain that a certain brand of oil caused burning to their trees. No grower who has not an efficient agitator in his spray vat can possibly attribute injury to the spray oil as such. The oil and water should be measured. Haphazard guessing is the cause of much trouble. The procedure for mixing an oil spray is simple. The required amount of oil is measured into a tin and about twice that volume of water added. The emulsion is obtained either by pouring the mixture backwards and forwards several times from one container to another, or by forcing the mixture through a fine nozzle with a bucket pump. When the oil has thus been emulsified it is further diluted by being added to the bulk of the water in the vat.

Lime Sulphur.

Lime sulphur is a complex mixture of polysulphides of calcium together with small quantities of other compounds containing calcium, sulphur, and oxygen. It is a most useful spray material, and is probably

the one material which should be used on every citrus orchard in this State every year. Formerly lime sulphur was used extensively as a scalicide against a number of species, but for this purpose other substances, particularly oils, have displaced it to a very large extent. In Queensland at the present time lime sulphur is used for the control of one species only, namely white louse. At the same time it is effective to a certain extent against the crawlers of several other species of citrus scale insects, and in using lime sulphur against white louse a certain degree of control is exercised against these other species. Liquid lime sulphur is the form most commonly employed, and all recommendations for the use of this spray on citrus in Queensland refer to this form. In some parts of the world dry lime sulphurs are used to a certain extent, but the scalicidal value of these appears to be definitely lower than with the wet sprays.

For the most part, commercially made lime sulphur is employed, but the mixture can be prepared on the farm if so desired. Particulars of the preparation of home-made lime sulphur are to be found in "Pests and Diseases of Queensland Fruits and Vegetables," by Robert Veitch and J. H. Simmonds, a handbook published by the Department of Agriculture and Stock. Generally speaking, the home-made lime sulphurs are not altogether satisfactory. It is quite commonly found that the home-made operation may be successful several times and the next quite unsuccessful, though no known variation in the procedure has been adopted. A few citrus growers in the State do make their own lime sulphur and find it quite satisfactory, but it is considered that, on the whole, purchasing the manufactured concentrate is more satisfactory.

The strength of lime sulphur is indicated by the density, and to determine this a Baumé hydrometer is necessary. Concentrate prepared by the method given by Veitch and Simmonds will usually be found to be between 24° and 28° Baumé. It is the common experience in making home-made lime sulphur to find that the densities of successive lots vary considerably. Further, even commercial brands vary from one another, and even between different samples of the one brand. All recommendations for the use of lime sulphur at certain strengths are based on the assumption that the concentrate is about 32° or 33° Baumé, and it may therefore be necessary to make adjustments with different lots of concentrates. The following table, taken from "Pests and Diseases of Queensland Fruit and Vegetables," will enable the adjustments to be computed readily:—

TABLE I.

Density of Stock Solution in Degrees Baumé.	Dilution Required Based on a 33° Baumé Standard.				
	1 to 10.	1 to 15.	1 to 20.	1 to 30.	1 to 40.
25	7·6	11·4	15·2	22·7	30·3
26	7·9	11·8	15·8	23·6	31·5
27	8·2	12·3	16·4	24·5	32·7
28	8·5	12·7	17·0	25·5	33·9
29	8·8	13 2	17·6	26·4	35·2
30	9·1	13·6	18·2	27·3	36·4
31	9·4	14·1	18·8	28·2	37·6
32	9·7	14·5	19·4	29·1	38·8
33	10·0	15·0	20.0	30·0	40·0
34	10·3	15·4	20·6	30·9	41·2
35	10·6	15·9	21·2	31·8	42·4

It must be remembered, however, that of itself the density of lime sulphur gives little true idea of its insecticidal value, and because two such solutions are both 33° Baumé it does not follow that the insecticidal efficiencies are equal. The value of lime sulphur as an insecticide or fungicide has been shown to depend largely on the polysulphides present, and to gauge accurately the strength of the concentrate the percentage of polysulphides must be known. If, therefore, there is any doubt as to the composition, an analysis must be made if definite information is to be obtained.

Lime sulphur is used at strengths varying between one part of the concentrated stock solution to ten parts of water, and one part of the concentrated stock solution to thirty of water, or more according to the purpose for which it is required and the time of the year at which it is to be applied. The higher the prevailing atmospheric temperature the more dilute the lime sulphur must be. At strengths less than 1—15 lime sulphur has little value as a scalicide on citrus. It is the practice in some orchards to use this material regularly much stronger than 1—10, but such strengths are very rarely required for any purpose, and whilst little damage to the tree may result, lime sulphur is not a particularly cheap material and excessive strengths should therefore be avoided. With strengths such as 1 to 4 which are sometimes used in the winter little direct injury may be noted, but there is some reason for thinking that normal blossoming may be affected.

Correctly used lime sulphur is one of the most beneficial sprays known for citrus, at least in so far as Queensland is concerned. All the damage done by this spray is caused through using over-strengths. On the trunk and main limbs which are at all effectively protected from the sun, lime sulphur may be used at almost any strength at any time, but during the summer months foliage and tender twigs may be badly burned if the strength be greater than about 1—20, and in the hottest times of the year 1—30 or 1—35 is as strong as the material should be applied. Injured leaves are quickly shed, and fruit may also fall. More generally, however, burned fruit remains on the tree even if injured when quite small. If young fruit be injured the marking may grow in size with the fruit, and thus a very small amount of original injury may cause a considerable blemish to the rind of the mature fruit. As a scalicide lime sulphur is not used at less than about 1 to 12, and, therefore, its use for this purpose is confined to that period of the year when the only trees bearing fruit would be lemons and perhaps late valencias.

Washing Soda Wash.

A wash containing 1½ lb. washing soda to 4 gallons water formerly was used extensively for the control of wax scales, but it is now rarely used in Queensland, its place having been taken to a very large extent by the following mixture of soap and washing soda.

This spray has been displaced mainly on account of its rather drastic action on the trees. Under Queensland conditions the wash to be effective must be used in rather warm weather and severe injury to leaves and tender twigs frequently follows its use. The effect is particularly bad on weaker trees, and partial or even total defoliation may occur. In addition to this injury the washing soda spray has a definite tendency to harden the bark, and on healthy trees this is the greatest

objection to its use. The spray, however, cannot be considered a dangerous one to trees in good condition provided it is not used too regularly.

Soap and Washing Soda Mixture.

This mixture is made according to the following formula:—24 cakes Sunlight soap, 12-14 lb. washing soda, and 75 gallons water. To prepare the spray, dissolve the washing soda in as much water as can be boiled conveniently, and then add the soap. The soap will dissolve more readily if it be shredded. The mixture is then heated until all the soap has dissolved. Unless the quantity of water be very small it will probably not be necessary to actually boil the solution. The concentrate thus prepared is then diluted to 75 gallons in the spray vat. The mixture should be well agitated during the application. The spray is essentially a foliage one, and the application should be liberal.

Common soap may be substituted for Sunlight, but in no case have the results with other soaps equalled those obtained with the Sunlight. Clean fresh washing soda only should be used in making the mixture.

The addition of the soap is found to allow of considerable reduction of the washing soda without greatly impairing the scalicidal efficiency against the principal wax scale, that is, the pink wax, and at the same time the reduction in the amount of soda definitely reduces the harmful effects of the soda as described for the old washing soda wash. The soap tends to cause the spray to spread better, and assists in this regard also. The possible ill effects are similar to those given for the straight washing soda wash, but, as indicated, are felt to a considerably lessened degree.

Oil-Soap-Washing Soda Spray.

A combination of the soap and washing soda spray with oil is sometimes of value as a scalicide, especially when it is desired to combat mussel and pink wax concurrently. The mixture is also more effective against mussel scale than is straight oil. It is advisable to reduce the amount of soap and soda. In experimental work satisfactory results were obtained with the following proportions:—8 cakes Sunlight soap, 8 lb. washing soda, 1½ gallons oil, 75 gallons water. Oil and washing soda without soap is sometimes used. In hot weather, however, this spray is likely to cause severe burning to the leaves, and it is always advisable to include soap in the mixture. The soap spreads the spray well and prevents its accumulation into drops which is generally responsible for the burning that results.

Any injurious effects following the use of this spray are mainly attributable to the oil it contains, and the damage is comparable to that done by oil alone. In some respects this spray is rather more drastic than straight oil, however, and its use should be confined to late summer and autumn months.

Resin-Soda-Fish Oil Spray.

This mixture gives a most efficient scalicide spray. Its greatest value is in the control of complexities of pests which include scale insects, but were it not that the preparation is rather cumbersome and requiring some little time, its use could be extended with considerable benefit. In those instances where it is recommended growers will find that they are fully compensated for the extra time and work involved

in its preparation. The formula of the spray is 10 lb. resin, 3 lb. caustic soda of good commercial quality, 1½ lb. fish oil, preferably herring oil, and 40 gallons water. The procedure for preparing the spray is as follows:—Firstly grind up the resin as finely as practicable, and then either mix the resin and the caustic soda while dry and add the mixture of these solids to 2 gallons water, or dissolve the caustic soda in the 2 gallons water and add the resin slowly while the solution boils gently. Generally the latter procedure is adopted. Whichever method be used the mixture must be boiled until a clear dark solution is obtained. The solution expands when hot, and if the volume of water be much in excess of half that of the container boiling over may occur. The fish oil is added to the clear dark solution when this is obtained, and the whole boiled for a few minutes to ensure that no free oil remains. The concentrate thus prepared is diluted for use with cold water. The agitator should be kept running while the application is in progress. If the concentrate is to be stored the fish oil should not be added before storage unless the mixture can be kept in perfectly airtight containers. When the concentrate cools a certain amount of solid is deposited, and thus when large lots are being prepared it is necessary to divide the stock solution while hot. This may be done by reheating stored lots or dividing up as soon as prepared. As most spray vats in use in Queensland have a capacity of either 40 or 75 gallons, the stock solution will be divided into lots of 2 or 3¾ gallons. The former method is preferable as it enables the addition of the fish oil at this stage to be made in such a way that thorough mixing is easy and assured.

In addition to its scalicidal value the spray has many beneficial effects on citrus trees, and if made correctly and applied at the right time it is an excellent general spray for these trees. It is, however, important to prepare the spray carefully, otherwise severe injury may follow its use. It is essential that the clear dark liquid described above be obtained, and all cases of injury to trees following the use of this spray in cool weather have been attributable to carelessness in preparation.

This spray must not be used in the very hot weather, and, in general, application should not be made when the temperatures exceed 90° F. Its general use, however, is restricted to periods when the temperature is about 10° lower than that maximum. If used in too hot weather severe burning followed by fall of both leaves and fruit may occur. Injured leaves and fruit are usually marked with a sticky deposit. This deposit may be present to a slight extent on uninjured parts, but does not persist on these, and the fruit may be covered with the material within a few days of being harvested.

COMBINATION SPRAYS.

It is possible under certain circumstances to mix a scalicide with a second spray to produce a combination which may be used with safety on the trees, and which at the same time retains the insecticidal or fungicidal properties of each of the constituent materials. Where this can be done it is very desirable for reasons both of economy and convenience. In mixing two spray materials in this way there are often precautions to be adopted, and because two such materials are stated to be compatible it does not necessarily follow that direct mixing can be done. Orchardists should therefore familiarise themselves with the

details of the preparation of such combinations. The following mixtures which include scalicides are of value to citrus growers in this State.

Lime Sulphur and Oil.

To a certain extent the mixture of oil with lime sulphur comes under the heading of both combination and simple spray. Whilst the properties of the lime sulphur for purposes other than the control of scale insects are preserved, the mixture also forms a spray which, under certain circumstances, is a better scalicide than the straight oil. Most miscible oils do not form stable emulsions in the presence of lime sulphur unless a special emulsifier be added. The emulsifier or stabiliser for the purpose is casein. The casein is dissolved in the water and the previously emulsified oil is then added. This mixture is agitated well and the lime sulphur then added. The amount of casein required varies with different oils and different lime sulphurs, but generally 1 lb. of casein to each 100 gallons of spray suffices. There are a number of white oils on the market which can be mixed directly with lime sulphur, and when the combination is desired they are usually preferable. Such oils are usually specially marked as directly miscible with lime sulphur.

Oil, lime sulphur combinations are very useful, but should be used with great care, as severe burning of fruit and foliage may result if the mixture be applied in very hot weather. The maximum safe temperature can be set down as about 90°F. It is, however, unwise to use the combination at the maximum temperature unless the trees be in good condition. In this State the use of the combination spray is therefore restricted to early summer and late summer or autumn months. The spray is particularly severe on young growth, and its use at times when there is much new growth cannot be recommended. It should not, of course, be used on dormant citrus trees.

Bordeaux Mixture and Oil.

Oil may be added to Bordeaux mixture to form a safe combination spray provided the oil be well emulsified before it be mixed into the other material. The procedure recommended is to use a good brand of oil, thoroughly emulsifying it with about double its own volume of water. When a good emulsion is obtained stir it well into the prepared Bordeaux mixture. The amount of oil to be used is generally mentioned as 1 per cent., but this amount can be exceeded by ½ per cent. without injury to the trees. The essential point to be observed is that there must be no free oil present at any time during the application. Whilst the 1 per cent. combination has some scalicidal value it cannot be recommended as likely to be of much value against heavy infestations of most scale insects. It is, however, of use on lightly-infested trees. The greatest point in favour of the mixture is the improved spreading quality of the Bordeaux.

Oil and Nicotine Sulphate.

Oil and nicotine sulphate may be safely mixed. A spreader is sometimes added to ensure greater safety, but this is not essential. Nicotine sulphate is, however, very seldom required on citrus in this State, being used on citrus only for the control of aphis. This insect rarely needs to be artificially controlled, and when this is necessary it is usually at a

time when the trees are very susceptible to injury from oil sprays. The combination is therefore of little value as a citrus spray in Queensland.

Lime Sulphur and Arsenate of Lead.

Lime sulphur may be mixed with acid arsenate of lead to form a very useful and safe spray combination. However, when used in this way lime sulphur is not being employed as a scalicide as a general rule, but for the control of Maori mite or red spider. On occasions, however, the combination may be used in connection with the control of scale pests. In mixing the two materials the lime sulphur is added to the water in the first place, the arsenate of lead being mixed separately into a paste in the same way as when the poison is being used alone. A little more water is then added to the arsenate of lead paste and the whole mixed into the lime sulphur solution.

Soap and Washing Soda and Burgundy.

Burgundy mixture may be combined with soap and washing soda mixture to form a combined spray for use against wax scales and fungi. The mixture is at times very useful. The two sprays should be prepared separately and mixed later. In experimental work a little burning was caused at times when full strengths of both constituents were used, and though this was never serious and not invariable, it is perhaps advisable to reduce the soap and washing soda in the scalicidal portion of the spray. It was found that the soap may be reduced to fifteen cakes and the soda proportionally without undue loss of scalicidal efficiency.

Soap and Washing Soda, and Nicotine Sulphate.

Soap and washing soda, as described in an earlier paragraph, and nicotine sulphate may be mixed together to form a useful combination spray. It sometimes happens that towards the end of summer, particularly in years when the rains have been falling over a protracted period, the late growth may not harden for a considerable time and the aphis then becomes somewhat of a menace and may need attention. In such years pink wax control may be required at a time at which the aphis can be conveniently combated. Under these circumstances the combination of soap and soda with nicotine sulphate may be of value. The nicotine sulphate is added to the soap and washing soda in the usual proportions, that is, ½ pint to 50 gallons.

Soap and Washing Soda, and Lime Sulphur.

This combination has a very limited use. It is only of value when a protracted hatch of pink wax has occurred, and it becomes necessary to combat pink wax and Maori at the same time. The spray must be used with great care, as severe burning often results. On no account must the amount of soap be reduced. The combination is too drastic to permit of its being generally recommended, but at times it may be of use.

COMPATABILITY OF FOLLOWING TREATMENTS.

There is no problem which citrus growers of this State have to face which gives more concern than the question of what sprays may be safely used in succession to one another. The trouble is due to a large extent to the use of fungicides containing copper compounds as the

principal ingredient. Once such a spray has been used many of the most useful scalicide materials cannot be employed for a considerable time. The search for substitutes for these copper containing sprays has so far met with little success. Attention has recently been directed to the use of zinc sulphate and lime as an alternative to copper sprays for certain diseases. This spray has so far not been proved to be of any value against the major fungous troubles of citrus in the State, and there does not appear to be much likelihood that this substance will be recommended as a substitute for Bordeaux or Burgundy mixtures for general use on citrus.

The question of compatability is, of course, not confined to the class of sprays just mentioned, but must be considered with other sprays also. It is advisable, therefore, in drawing up a programme of pest and disease control, to give full consideration to the compatability of all the sprays which may need to be used for the following twelve months. The more important following treatments are discussed below.

Bordeaux Mixture and Oil.

Although Bordeaux mixture and oil may be used as a combination spray care must be exercised in applying the two as separate sprays to the one tree. In general at least two months should elapse after an application of Bordeaux before oil is applied, and unless the removal of residual Bordeaux has been assisted by good rain it may be advisable to wait still longer. In practice, however, two months usually suffice, for unless an appreciable amount of rain has fallen in that interval the trees will not be in a fit condition to spray with oil. That Bordeaux may follow oil within a shorter period is of little value, for in the control of most of the major diseases of citrus in this State the initial fungicide application must be made early in the spring and the treatment repeated at least once before mid-summer. Thus the use of oils before Bordeaux cannot be recommended for reasons arising out of the use of oil alone. The only occasion on which the procedure may be required is when rots of the fruit such as are caused by *Phytophthora citropthora* Sm. et Sm. occur. This type of rot is uncommon and is only in evidence in wetter times. In such cases Bordeaux may be applied to trees previously sprayed with oil when desired, for the latter material will always have been used in the late summer or early autumn and the rots are never much in evidence until well into the winter.

Fumigation and Bordeaux Mixture.

The effect of fumigating a tree which carries a residue of Bordeaux is disastrous, and at least six months should be allowed to elapse after applying the spray before fumigation is carried out. Even in that length of time the procedure cannot be said to be entirely without risk. To definitely eliminate all possibility of damage the period would have to be almost twelve months. In experimental work a number of trees were fumigated less than three months after having been sprayed with Bordeaux and no injury resulted. This was done in a very dry period following one of heavy rain, and it would appear that under such circumstances the intervening period may be considerably reduced. However, if less than six months be allowed to elapse great care must be exercised, and orchardists should proceed slowly. As the damage to the trees is so great no chances should be taken, and in general it cannot be recommended that fumigation should follow Bordeaux spraying within six to eight months according to weather conditions.

Bordeaux mixture may, however, be applied quickly after fumigation. Although in theory the spray may be applied immediately after the fumigant has left the tree, in practice it has been found advisable to wait at least ten days.

Lime Sulphur and Bordeaux Mixture.

The use of lime sulphur against white louse in the late winter may need consideration in cases where Bordeaux is to be applied early in the spring. When these two materials are mixed a heavy black or dark-brown deposit, probably a copper sulphide, is formed. This precipitate is very insoluble, and apart from covering the trees does no damage. The reaction which brings about its formation, however, leads to a reduction in the efficacy of both spray materials, and the close following of one spray by the other in either order is therefore to be avoided as far as possible. In general the order in which the material will be applied in so far as scale insects enter into the question is lime sulphur first and then Bordeaux. The reverse order may be required when Maori mite or red spider control has to be undertaken. The question of spraying programme in these cases will be dealt with in connection with the control of such complexities in the discussion of the control of scales in various districts.

Bordeaux Mixture and Resin-Soda-Fish Oil.

These sprays may be applied within about a month of one another in either order without injury to the tree. In practice, however, there are few, if any, occasions on which Bordeaux will be required to follow the resin spray in so short a time. The reverse procedure is much more commonly called for, and as the sprays may be used in quick succession the resin-soda-fish oil mixture becomes a most valuable scalicide.

Oil and Resin-Soda-Fish Oil.

The resin-soda-fish oil spray should not be applied within less than at least three months of an oil. If the sprays be applied in that order in too short a time, heavy fall of leaf is probable and small twigs may be killed. In the experimental trees the injury to well-grown fruit was, however, slight. The reverse order of application is not likely to be considered and has not been tested.

Lime Sulphur and Oil, or Sulphur and Oil.

The problem of following lime sulphur or sulphur with oil can be overcome largely by the use of a combined spray of oil and lime sulphur. Where it is known that both materials will need to be used at about the same time the combination should always be used if conditions permit. In no case should oils be used immediately following sulphur dust or lime sulphur. In the case of lime sulphur the period between the two applications should be at least one month, but preferably longer. If the combination spray cannot be used owing to weather or other such circumstances, it is preferable to use sulphur dust rather than the lime sulphur for the control of mites.

Fumigation and Oil.

Fumigation may be followed by oil spraying, or oil spraying by fumigation within a few days without injury to the trees. Unless it be

unavoidable, however, it is wise to allow at least a fortnight to elapse between the treatments. There should never be any occasion in Queensland for requiring the two treatments within such a short period of one another. If it be known in advance that both these treatments will need to be given, it is recommended for preference that the fumigation be carried out first.

FUMIGATION.

Whatever method of generating the gas be used the procedure in fumigating a citrus orchard is essentially the same. The tree to be treated is first covered with a tent. These tents, or sheets as they are usually styled, may be of any material which fulfils the following conditions:—It must be of close enough weave to ensure that the gas will escape only very slowly, strong enough to stand the wear to which it will be subjected by being dragged around the orchard and over the trees, and not so heavy that it will be difficult to handle in this work. Most fumigation sheets in use are made of duck or drill. Drill is inferior to duck, and the most satisfactory material employed is special 8—10 oz. army duck. A medium weight calico of close weave gives perfectly satisfactory results in so far as the kill of insects is concerned. This material has the advantage that it is cheaper to purchase than the duck, but the life of a calico sheet is, of course, less than the stronger duck. Calico would perhaps appeal most to orchardists starting with an orchard which has not yet commenced to pay its way, and in this and other cases may be of considerable value. In the experimental work a medium weight close woven English calico, costing 1s. 6d. per yard (72 inches wide), was used. The results obtained with this were equal to those obtained with 10 oz. duck costing approximately 2s. 6d. per yard. Thus from about £25 to £30 will be saved by using the calico for an equipment of twelve sheets.

The sheets are usually eight-sided and are of various diameters. The number of sheets will depend on the size of the orchard and the means of the grower, but where possible an outfit should include at least twelve sheets, and twenty can be easily handled by a gang of four men who know anything about fumigation. The diameters will depend on the size of the trees, and in purchasing sheets due allowance must be made for the growth of the trees during the following five or six years. If given careful treatment a sheet should last at least that length of time, and it is unwise to acquire tents which will be of no use long before they are worn out. Sheets may be enlarged by adding an extra width of material to the edges, but it is much better to obtain whole sheets in the first instance. The smallest size sheet which should be purchased should be about 30 feet in diameter. If a sheet is to be enlarged drill may be used, as it is quite satisfactory to form the flaps towards the bottoms.

The size of the sheet required to cover a tree varies with the habit of growth of the tree, and it is difficult to give an accurate idea on this point. An Emperor of Canton mandarin 10 feet high, for example, will usually be covered by a much smaller sheet than a Scarlet of the same height. The sheet should reach well to the ground, and allowance must be made for that fact. Roughly it may be said that a well-shaped tree 10 to 12 feet in height will require at least a 33-foot tent, and more probably a 36-foot one will be needed. The largest sheets commonly used are 55 to 60 feet in diameter, though on some Queensland orchards 80-foot sheets are in use.

In order to protect the sheets from attack by mildew these are sometimes given a treatment with tannin. This treatment tends to lengthen the life of the tent, but there is no evidence that it increases its gas-holding capacity. The tents are treated by being dipped in a vat of hot tannin solution. They are immersed for about half an hour and then spread out on the ground to dry. The strength generally recommended is 40 lb. of bark to about 100 gallons of water, but as the tannin content varies a definite amount of water cannot be given.

In fumigating an orchard a tent is placed on the end tree of each row for as many rows as there are tents. The tent is hauled over the tree with the aid of one or two poles according to the size of the tent and tree. These poles should be light and at least 18 feet long for use in most orchards, particularly where lemons are grown. The essential point about the poles is that they must be sufficiently long to allow of the tent being raised in such a way that branches towards the top of the tree will not be caught under the sheet when it is being pulled up. With short poles limbs are frequently broken by being so caught, and the risk of the sheet being torn is greatly increased. From the first tree in each row the sheet is transferred directly to the next. That is, after the first tree each day the sheets are not again brought to the ground except at the conclusion of operations.

The dosage is calculated on the amount of space beneath the sheet. This depends on the dimensions of the sheet when in position. There are two systems in use—the distances over and around, and height and diameter. The former gives a rather more accurate result, but in Queensland the height and the diameter are the measurements almost always taken. These give sufficiently accurate data. The distance over the tree may be found most easily by marking the sheets, so that when in position the measurement is automatically registered, and in this case the distance around is obtained by running a tape around the outside of the sheet. The height may also be found by a marked sheet, but generally a light pole plainly marked in feet is used, and this pole is also used for determining the diameter. The markings must be plain enough to be readable when the pole is in the vertical position against the high trees. The dosage is determined by reference to tables specially prepared for the purpose (see Tables II., III., and IV., pages 22, 23, and 24).

If the "pot" method be used the only other equipment necessary is the earthenware pots and the various measuring vessels and supply vats. With any other method a machine is either necessary or desirable as described in connection with each in earlier paragraphs. If Cyanogas is being employed it is desirable to obtain a supply of specially-graduated spoons. These spoons hold exact known quantities of the dust and thus save any weighing and allow quick and accurate working.

Conditions and Precautions.

In almost every fumigation season numbers of trees are injured or poor results obtained against scale insects through neglect by fumigators to observe conditions which, for the most part, are quite well known. Fumigation is no work for a careless man, and, if the safety of trees and operators combined with good results against the pest are to be

TABLE II.

POTASSIUM CYANIDE.

45 MINUTES EXPOSURE.

Diameter of Tree (feet).

Height of Tree (feet).	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
4	1	1	1	1																
5	1	1	1	1½	2															5
6		1½	1½	2	2	2½	3	4	4											6
7		1½	1½	2	2½	3	4	4	4	5										7
8				2½	3	3	4	4	5	6	6	6	7							8
9				2½	3	3	4	4	5	5	6	6	7	7						9
10				3	3	4	4	4	5	5	6	6	7	8	9					10
11					4	5	5	5	6	6	7	7	8	9	10					11
12						5	5	6	6	6	7	8	8	10	11	12	13	15	17	12
13						6	6	7	7	7	8	9	9	12	13	14	15	16	18	13
14							6	7	7	8	9	10	11	13	14	15	17	18	18	14
15								7	8	8	10	11	12	14	14	16	18	20	20	15
16									9	10	12	12	13	14	15	17	18	20	21	16
17										12	13	13	14	15	16	18	20	22	22	17
18											13	13	15	16	18	20	22	23	24	18
19												15	16	18	19	21	23	25	25	19
20													17	19	21	23	24	25	26	20
21													19	19	21	23	25	26	27	21
22														21	22	24	25	26	27	22
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	

Doses in Ounces.

Proportion: Cyanide, 1; Sulphuric Acid, 1; Water, 3.

TABLE III.

CYANOGAS DUST.

45 Minutes Exposure.

Diameter of Tree (feet).

Height of Tree (feet).	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
4	1	1	1	1½																4
5	1	1	1½	1½																5
6	1	1½	1½	1½	2	2½	3	4	4											6
7	1	1½	1½	2	2½	2½	3½	4	5	5½										7
8		1½	1½	2	2½	3	4	4½	5½	6½	7½	8½	10							8
9			2	2½	2½	4	4½	5	6	7	8½	9½	11	12½						9
10				2½	3	4	4½	6	7	8	9½	10½	12	14	15½					10
11					3½	4½	5	6½	7½	9	10	12	13½	15	17	19				11
12					3½	4½	6	7	8	10	11	13	14½	16½	18½	20½	23	25	27½	12
13							6	7½	9	10½	12	14	16	18	20	22	24½	27	30	13
14							7	8	9½	11	13	15	17	19	21½	24	26½	29	32	14
15								8½	10	12	14	16	18	20½	23	25½	28½	31	34	15
16								9	11	13	15	17	19½	22	24½	27½	30½	33½	36½	16
17									11½	13½	16	18	20½	23	26	29	32	35½	39	17
18									12½	14½	17	19	22	24½	27½	31	34	37½	41	18
19									13	15½	18	20½	23	25	29	32½	36	39½	43½	19
20									13½	16	18½	21½	24½	27½	30½	34	38	42	46	20
21												22½	25½	29	32½	36	39½	44	48	21
22												23½	26½	30	34	37½	41½	46	50½	22
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	

Doses in ounces.

Table recommended by manufacturer and used in experimental work.

TABLE IV.

CALCID BRIQUETTES.

40 MINUTES EXPOSURE.

Diameter of Tree (feet).

Height of Tree (feet).

	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
4	1	1	1½	1½																4
5	1	1	1½	2																5
6	1	1½	1½	2	2½	2½	3	3½	4											6
7	1	1½	2	2	2½	3	3½	4	4½	5										7
8		1½	2	2½	2½	3	3½	4½	5	5½	5½	6	7							8
9			2	2½	3	3½	4	5	5½	5½	6	7	8	9						9
10				2½	3	3½	4½	5	5	6	7	8	9	10	11					10
11					3½	4	4½	5	6	7	8	9	10	11	12	13				11
12					3½	4	5	5	6	7	8	10	11	12	13	14	16	17	19	12
13							6	6	6	7	9	10	11	13	14	16	18	20	22	13
14							6	6	7	8	9	11	12	14	16	17	19	21	23	14
15								6	7	8	10	11	13	15	17	19	21	23	25	15
16								7	8	9	11	12	14	16	18	20	22	24	27	16
17									8	10	11	13	15	17	19	21	24	26	29	17
18									9	10	12	14	16	18	20	22	25	28	30	18
19									10	11	13	15	17	19	21	24	26	29	32	19
20									10	11	13	15	18	20	22	25	28	31	34	20
21												16	19	21	24	26	29	32	35	21
22												17	19	22	25	28	31	34	37	22
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	

Doses in Number of Briquettes.

Table recommended by manufacturer and used in experimental work.

ensured, attention must be paid to detail. The most important conditions which are to be observed may be briefly stated as follows:—

If the pot system is being used the work must be done in the absence of sunlight, for if this method be used during the day serious injury to the trees may result. Calcium cyanide, however, may be safely used in the day time, even on the brightest days.

It is essential that the dimensions of each tree be determined accurately. Guessing the dosage is very inadvisable.

The humidity of the atmosphere must be considered. Wet trees must never be fumigated, and generally it is wise to cease operations when there is any damp feeling in the air. With calcium cyanide humidity is usually of minor consideration, but when night work is being done dew often necessitates discontinuance. Very often work is commenced in the morning with sheets which are far from dry, and this leads to much trouble. When there is any chance of the sheets becoming wetted overnight, they should be placed under shelter. Even if they be but placed in a group and covered by one other sheet a good deal of time and trouble can be avoided. Wet sheets pick up much dirt and grit, and scratching of the fruit results from friction when the sheets are being pulled over the trees. Scratched fruits, besides being blemished, are more susceptible to cyanide injury than sound ones, and the sheets should therefore be kept as clean as practicable.

Temperature is of greater consideration than humidity as a rule. When the pot method is being employed fumigation should cease when the temperature is greater than about 75°F. in coastal parts and 80°F. in interior districts. When calcium cyanide is being used, however, the upper limit is much higher, and under most conditions healthy trees remain uninjured at temperatures 10° to 15° F. higher in both cases. In many cases trees have been fumigated with calcium cyanide in interior districts at 100°F. or even a little higher with very little or no ill effects. Care, however, must be exercised when working at these very high temperatures, and a close inspection made so that if any damage is being done it will not go too far. As a general rule on typical hot summer days in Queensland it is advisable to discontinue fumigation between about 12.30 p.m. and 3 p.m.

The tree should be covered for about forty-five minutes. Under good fumigating conditions, particularly if the humidity be fair to good, the interval may be reduced to forty minutes, but under no circumstances should the time be extended to more than about fifty minutes. There is nothing to be gained by increasing the time to an hour as is sometimes done, and there is distinct risk of injury. Further, it is not advisable to have the trees covered for any great length of time before the charge is applied.

The soil of the orchard should be sufficiently well cultivated to permit of the sheets making good contact, and often it is desirable to throw a little soil on the bottoms of the sheets so that they make close contact with the ground. The soil should not be so wet that the humidity of the amosphere enclosed by the tent will quickly be altered appreciably, and for this reason irrigation should not immediately precede fumigation. At the same time trees which are suffering from lack of water are definitely less resistant to the gas than others, and in general the healthy trees suffer less than those in poor condition.

Different varieties of trees show different tolerance to the gas. With the pot method lemons usually are found to be more resistant than oranges, and oranges more so than mandarins. With calcium cyanide, however, the order is different. Oranges are the most tolerant when this form is used, and lemons markedly the least. Under Queensland conditions, however, the order of tolerance is rarely of moment. Young growth in all cases is more susceptible to injury than is hardened growth, and when there is much new growth on the trees fumigation should be postponed as long as possible. In no case with trees other than lemons, where it cannot be avoided, should trees carrying fruit less than about three-quarters of an inch in diameter be fumigated. In ideal circumstances fruit which is well set is not usually affected to any appreciable extent, but fumigation is not to be recommended at so early a stage in the development of the fruit.

Care must be taken to see that the sheets are as gas-tight as possible. They must be touching the ground firmly all round, and all folds must be arranged so that they do not enclose any great air space. Careful inspection should be made at short intervals for tears, and these should at once be mended. Many tents become badly torn because small holes are not attended to early. Apart from the efficiency of the fumigation being lowered in the meantime, sheets are too expensive to treat in this way.

Fumigation is seldom effective if carried out in windy weather. The wind tends to increase the leakage, and fumigation under badly-flapping tents is useless. Furthermore, it has sometimes been observed that the kill is less on trees close to ones fumigated in windy weather than would normally be expected. It would appear possible that in such cases the insects on the former trees may receive sub-lethal doses carried to them by the wind and thus develop a tolerance to the gas. The resistance is small and does not apparently persist, but it is advisable for this reason, as well as others connected with the insects themselves, to work towards the wind and refrain from fumigating in very windy weather.

SPRAYING.

It is obvious that no matter how high the insecticidal efficiency of a material may be the insect must receive a certain amount before any result can be expected. In the case of contact insecticides in use against scale insects this means that the pest must be adequately covered by the spray. It is therefore necessary to know just how the material was applied before any assessment of its worth can be made. Bad spraying is much more common than bad sprays, and every year quite good spraying materials are condemned by growers who do not take into consideration the manner of application. It is by no means an easy task to spray a well-grown citrus tree thoroughly, and if satisfactory results are to be obtained against scale insects by the use of sprays, attention must be paid to details.

In spraying there are two important units—the man and the machine. For efficiency an active man is necessary, otherwise both time and material will be wasted. No man can effectively spray unless he gives the whole of his attention to the work. For this reason also a good horse is an asset, for if a man has to be continually speaking to and looking at the horse he cannot possibly give adequate attention to the work on hand.

It is advisable to work always to a system. Any system which ensures that the whole of the tree will have the maximum chance of being covered must include the following points:—The inside of the tree will be done first, and each branch will be traced out to its end. Special attention must be given to topmost parts. In spraying the outside it is necessary in the first place to make sure that the hose will reach to every part of the tree, and this can only be done by walking to the full length of the hose before commencing at each tree and then working back towards the machine. If this is not done it may be found on walking round the tree that the hose is too short to reach the point where the spraying began. If the unsprayed section be large it will be noticed, but in other cases it may be left unsprayed. In either case there will be loss of time or efficiency. If two men be spraying together they should work at an even pace, otherwise one man will be wasting time and material or the other will skimp the last part of many trees.

The spraying outfit of many Queensland growers at the present time is hopelessly inadequate, and if scale control is to be improved much of the present equipment will have to be discarded. There are a number of very satisfactory machines on the market for reasonable prices, and it must be remembered that efficient spraying is a very profitable undertaking.

It is impossible to spray a citrus tree effectively with a pressure of less than 175 lb., and for really good work at least 300 lb. is necessary. Of almost equal importance to high pressure is constant pressure. It is not possible to do efficient spraying when the pressure is fluctuating over a range of about 75 or 100 lb. as is often found to be the case. The vat should be fitted with a good strainer, and above all an efficient agitator. Too much emphasis cannot be placed on the necessity for good agitation in the vat. Many spray materials are harmful to both the pump and the hoses, and residual spray material should be cleaned out immediately after an application is completed. Apart from this, cleaning eliminates accidents arising at the following spraying through the unintentional mixing of two incompatible materials or the application of the first material at the wrong time. The frequency with which growers neglect to repair small defects in the spraying outfit until these are actually required for use is rather remarkable. The result is often much inconvenience and loss of valuable time.

The hose should be about 30 feet long and of good quality. The junctions of hose to the pump and the rod should be kept tight. Nothing wears a hose out more quickly than kinking when the pressure is on, and kinks can be avoided to a large extent if the operator make two half turns instead of one complete turn. The rod should be long enough to ensure that the tops of the trees can be well sprayed. Six feet rods are the minimum length of much value, and generally 8-foot lengths are required. Light bamboo rods have the advantage that they are thick enough to hold with comfort and they do not become greasy with spray as do the metal ones. One nozzle to each rod gives fairly satisfactory results, but two set on a Y-piece, so that the cones of spray intersect about 9 inches from the opening, give by far the best results. The orifice in the nozzle should be as fine as the spray material being used will permit, and it must be remembered that the holes are enlarged quickly by certain materials. Lime sulphur is the only scalicide requiring a nozzle which is at all coarse. Drench spraying uses more

material and does not give as good a cover on citrus as the mist. The spray rod should always be held at an angle so that the leaves are twisted and not merely pushed out of the way, as happens when the spray is directed flat on to the surface.

Spraying should not be commenced whilst the trees are wet, and should be discontinued at least half an hour before rain. Most sprays will require at least that length of time to dry, and this must be given consideration. Effective spraying is not possible in very windy weather. These points are very obvious, but the frequency with which they are ignored is remarkable.

Spot spraying could be practised to a much larger extent than is the case, but it is bad practice to neglect to treat a particular tree merely because it is unproductive. If a tree is not worth spraying it should be destroyed and certainly not left as a breeding ground for pests and diseases.

Any citrus tree with the normal amount of foliage is difficult to cover with spray, but those which are correctly pruned are certainly more easily so treated than others. As a preliminary to any spraying it is necessary to prune the tree, and, in general, trees should be kept as open as possible, having due regard, of course, for the other effects of this on the tree.

In mixing sprays it is essential that the ingredients be measured, and a good deal of the trouble which occurs would be avoided if this point were borne in mind. Fresh materials should be used, and if it be necessary to keep materials for any length of time they should be stored in airtight containers preferably in a cool place. Water is an important component of every spray. Generally rain water is available for this purpose, but if well or other water must be used it is necessary to have a test made to discover its suitability. A water is not necessarily fit for spraying because it is declared suitable for certain domestic purposes.

Lime sulphur is the only scalicide used to any extent on citrus in this State with which a spreader is advisable, and for this casein may be used. Some of the miscible oils do not spread very well, and with these a small quantity of soap improves the spreading qualities.

COMPARISON OF FUMIGATION AND SPRAYING.

Judged purely from the standpoint of efficacy against every species of scale insect on citrus, where it can be correctly carried out fumigation is preferable to spraying. Unfortunately, however, fumigation cannot be recommended for use in several of the largest centres of production. On the Blackall Range and in similar localities climatic conditions prohibit the use of the fumigant for the greater part of the year. Here winds are practically constant and wet days numerous throughout the period in which the work would have to be done, and the continuity of operations would almost always be badly broken. In these districts spraying must therefore be used for the most part.

In all districts the numerous small growers find the cost of equipment too great, for not only is the initial outlay high but depreciation has to be considered. Again, in many parts fumigation does not eliminate the necessity for a spray plant. Even though fumigation is effective against a large number of pests there are others—for example, the bronze bug—which must be considered, and diseases such as melanose

(*Phomopsis citri*) and black spot (*Phoma citricarpa*) must be combated with wet sprays. Further, whilst fumigation is undoubtedly superior against scale and many other pests, other satisfactory methods are known, and therefore where outlay of money must be considered primarily growers generally do not use fumigation.

TABLE V.

TESTS OF SCALICIDES.

PERCENTAGE KILLS OBTAINED IN EXPERIMENTAL WORK. POOREST AND BEST RESULTS GIVEN: KILLS CALCULATED ACCORDING TO METHOD DETAILED IN TEXT.

——	Red Scale.	Circular Black Scale.	Mussel Scale.	White Louse.	Pulvinaria.	Pink Wax.	White Wax.
Fumigation—Pot method	95–98	96–99	97–99	98–99	*a*	92–97	*a*
Fumigation—Cyanogas	97–98	98–99	98–99	98–99	*a*	89–92	*a*
Fumigation—Calcid	98–99	98–99	*a*	98–99	*a*	93	*a*
Resin-Soda-Fish Oil	97–99	98–99 leaves 90–94 fruit	98–99	95–97	98–99	96–98	94–98
White Oil ..	94–97	97–98 leaves 85–92 fruit	87–93	89	94–95	*b*	*b*
Red Oil	94–97	97–99 leaves 87–92 fruit	89–93	89	94–95	*b*	*b*
Soap-Soda ..	*b*	*b*	*b*	*b*	*b*	94–96	88–91
Washing Soda ..	*b*	*b*	*b*	*b*	*b*	95–96	93–96
Oil-Soap-Soda ..	93–96	*a*	92–96	*a*	*a*	92–96	*a*
Lime Sulphur ..	*b*	*b*	*b*	94–97	*b*	*b*	*b*
Oil, Lime Sulphur	91–95	97–98 leaves 79–83 fruit	*a*	96	*a*	*b*	*b*

a No data.
b Scalicide of little or no value against particular pest.

At the same time fumigation is superior, not only in the action on scale pests but also because it is so much more thorough than the best spraying. For this reason, and because fumigation is effective against so many pests concurrently, it is almost invariably the most economical scalicide that can be employed in suitable districts. Where the outlay for equipment is not of paramount importance fumigation is to be recommended in preference to spraying. A good deal can be done by co-operative effort. A scheme whereby a group of orchardists purchases an outfit which is available to each member at all reasonable times for but a very little outlay has been shown to be practicable by the growers in the Gayndah district.

THE INFLUENCE OF BORDEAUX MIXTURE ON SCALE INSECTS.

The continued use of Bordeaux mixture on a citrus tree may profoundly influence the scale insect position, not only with respect to degree of infestation but also with respect to the species of scale insects present. It appears that the effects are produced principally in three ways—namely, by rendering the use of several important scalicides impossible without great risk of injuring the tree, by the destruction of entomogenous fungi, and by the effect of Bordeaux on the plant itself.

The first of these is at times the most important, but there is now some method by which the trouble can be overcome. In certain cases, however, even if the difficulty be surmounted by the use of an alternative scalicide there may be loss in efficiency resulting in increase in population.

The destruction of entomogenous fungi was at one time thought to be the outstanding, if not actually the sole, reason for the increase in scale infestation following the use of Bordeaux. This, however, does not appear to be the case, for the evidence collected during the course of this work indicates that it is only on very rare occasions that these fungi exercise any appreciable degree of control. Though the commonest fungi are found in every major citrus-producing district, in certain parts they are found only very rarely, and then but a few insects are affected as a general rule. However, it is almost invariably found that scale insect infestation increases whenever and wherever Bordeaux is used at all extensively.

It is considered that by far the most important factor in most cases is the effect of the spray on the tree itself. The effect is, of course, the more pronounced the more Bordeaux is used. For the control of most of the major fungous diseases of citrus in the State several applications of Bordeaux are necessary in fairly quick succession. Thus cumulative effects are the rule. It is known that the copper from the fungicide may be absorbed into the plant, and copper so absorbed may be incorporated into the chlorophyl, resulting in the destruction of that substance for the purposes of photosynthesis. It is possible that it is through the chlorophyl that the effect of the spray is felt, but whatever the actual process, it is certain that citrus trees repeatedly sprayed with Bordeaux lose vigour. Where very heavy applications are made the loss becomes visibly manifested in heavy premature leaf fall, reduction in crop, and production of much weak growth. It will be readily understood that scale insects are very sensitive to the condition of the tree, and loss of vigour is quickly indicated by these pests. It will be seen by reference to the habits of red and mussel scales that these species are quick to take advantage of weakened condition of trees. It is true also that it is these species which increase to the greatest extent following the use of Bordeaux. Were the position affected only by the destruction of the entomogenous fungi it would be expected that the species of scale originally or habitually present would show the greatest increase. This, however, is not the case. Thus in recently-conducted experiments Emperor of Canton mandarin trees which usually were found to carry an appreciable infestation of pink wax only were repeatedly sprayed with Bordeaux. On these trees pink wax soon became a very minor pest, and in fact on several trees was represented by but a very few individuals. At the same time both red and mussel scale, particularly the latter, increased to such an extent that at one stage it appeared likely that the trees would be killed, or at least very badly injured. These trees

were oversprayed for experimental reasons, but similar effects have been noted in many other cases. As all the species of scale mentioned are hosts of the commonest entomogenous fungus the decrease in pink wax can scarcely be accounted for in that direction. It is therefore considered that the increase in scale insect population following the use of Bordeaux in most cases cannot be attributed to the fungicidal action of that spray but to its adverse effects on the tree. Bordeaux mixture is a most valuable fungicide and must be used if certain of the more important citrus diseases are to be controlled. It is apparent, however, that when this material is to be used growers must take what action they can to ensure as good growing conditions as possible for the treated trees, and a scalicide must be included in the spraying programme for the year.

IMPORTANCE OF TIME OF APPLICATION OF SCALICIDES.

It is very commonly assumed that because a certain percentage of the scales on a tree have been killed that an equally good degree of control has been established. It is the common practice also for growers to submit specimens from sprayed trees asking for information as to the kill obtained. That the first assumption is unwarranted and how misleading the figures obtained in the second event may be is shown by the analysis of the results of the following experiments carried out during the course of this investigation.

In the first experiment trees heavily infested with red scale were sprayed during the early part of January. Counts made fourteen days after the application showed that approximately 98 per cent. of the red scales were dead. Six weeks later a further series of counts was made and the figures then available were:—

Average number of living scales per fruit before application—

Sprayed trees	31·2
Unsprayed trees	28·45

Average number of living scales per fruit at time of third count—

Sprayed trees	16·5
Unsprayed trees	401·6

Assuming the rate of reproduction on all trees to be the same, it will be seen that an apparent kill of 96·25 per cent. had been obtained. Allowing for errors due to inability to handle sufficiently large numbers of individuals, the kills computed fourteen days and two months after application agree fairly well. Taking the figures for the sprayed trees, it will be seen that although a kill of at least 96·25 per cent. had been obtained in January, at the end of February the trees still harboured half as many scales as when they were treated. Thus, though the lethal value of the spray was 96·25 per cent., the control value of the spraying by this time was less than 50 per cent., and of no commercial significance.

These trees were kept under observation during the following twelve months, and at no time were they commercially free of the scale. In the following January the average number of scales per fruit on the sprayed trees was 34·8 and the unsprayed 59·4. The sprayed trees were thus a little under 50 per cent. better than they would have been if left unsprayed.

In the second experiment, using the same spray against the red scale during the last week in March, the following figures were obtained:—

Apparent kill fourteen days after application, 97·8 per cent.

Average number of living scales per fruit before application—

Sprayed trees	396·4
Unsprayed trees	259·5

Average number of living scales per fruit at time of third count (that is, six weeks later)—

Sprayed trees	8·9
Unsprayed trees	283·0

Average number of living scales per fruit twelve months later—

Sprayed trees	1·3
Unsprayed trees	181·1

In this case at the time of the second count the figures show a lethal value of 97·94 per cent. and a control value of the spraying of 97·75 per cent. Further, these figures are more than maintained, for the trees at the end of twelve months were more than 99 per cent. better than they would have been if left unsprayed. It should be pointed out that comparisons of two trees over a period of twelve months may not always give valid data. In the interval the scales have been through five complete generations, and it cannot be assumed that conditions of life for the scales on all trees have been the same throughout the period. Red scale reacts quickly to the physiological condition of a tree, and, in turn, profoundly affects that condition; it is commonly found that at any one time parasites are more in evidence in crowded colonies than in sparse ones; the struggle for existence is not necessarily equal—to mention but one fact, it is a habit of red scale that the young settle down in close proximity to the mother, and therefore there must at times be considerable competition for food. However, it is quite obvious from the figures given that the lethal value of a spray and the control value of a spraying are by no means one and the same thing. In the first experiment from a 96·25 per cent. kill the control value in twelve months had become less than 50 per cent., whilst in the second, from a kill of less than 2 per cent. more the corresponding control value was approximately 99 per cent. The differences are caused by reason of the following. January is the month in which effective reproduction by red scale is at its highest, and February is also a period of prolific reproduction. From March onwards to the commencement of spring mortality is great, and reproduction is considerably retarded. Effective reproduction is again in evidence during the spring and early summer, but it is not until mid-summer that infestations multiply very considerably. That some of the trees improve without any treatment, or perhaps without further treatment, is due to several causes. In the first place the kill on the twigs is often better than on the fruit and the fruit is removed during the colder months. With the fruit a certain proportion of the scale is always removed. Natural mortality due to the work of parasites and predators and the influence of climatic conditions also vary. In the case of some of the trees in the second experiment the condition of the tree was certainly of limiting influence. As has been recorded above, red scale affects and is affected by the condition of the tree to a large extent. Thus, in the second experiment the control was such that the trees responded well during the following spring and the vigour improved to such an extent that the suitability of the tree to red scale

infestation was definitely lowered. This, however, cannot be dissociated from the control value of the treatment.

In the third experiment the species was pink wax scale. This is a slow-breeding pest, and control must be established against each of the two generations per annum. The spray in this case was applied approximately a month earlier than the time recommended. At the time of application 72 per cent. of the old scales were reproducing and young were plentiful. It is at such a time that many growers, becoming alarmed at the increase in numbers, apply control measures. In the case of this species the position is very different from what pertains in the case of red scale. There is no overlapping of generations, and the exact position is clear within six weeks or two months after reproduction is in evidence. Counts made on the trees used in this experiment gave the following figures:—

Average number of living young per leaf—

Sprayed trees	16·6
Unsprayed trees	153·0

In this case the migration of young is such an important factor that comparison of figures before and after treatment gives no significant information, and all that can be done is to use trees which are comparable in respect to pink wax infestation. From the above figures it would appear that a kill of 98 per cent. had been obtained. This figure was supported by counts of living and dead old scales, but as old scales fall very readily from the leaf after death the figures are not significant. However, examination of the figures in conjunction with what is known of the life history and habits of the scale show the assumption of a 98 per cent. control to be unwarranted. Many of the leaves on the unsprayed trees carried more than 200 scales, and it is obvious that that number will not survive. The amount of feeding space on the average leaf would not permit more than about half that number of scales to grow to maturity, and the competition for food would certainly be great, even with half the number. On the other hand, on the sprayed trees the maximum number of young on any leaf was twenty-five, and these therefore would have a very good chance of reaching maturity. The most important factor, however, is migration. It would be expected that arrivals from outside would be more likely to become settled successfully on the sprayed leaves where there is ample room than on the already heavily-infested unsprayed ones. The following counts made when breeding had ceased show the actual degree of control—

Average number of living scales per leaf on sprayed trees..	11·3
Average number of living scales per leaf on unsprayed trees	17·8

The drop in average in both cases is due to natural mortality together with the fact that a new growth of leaves had been produced. From the figures it will be seen that there has been a lasting control of about 37 per cent. from a kill estimated at 98 per cent. The actual kill was probably greater than that, since migration had no doubt occurred prior to the counting.

It is obvious from these experiments that in any test there must be a differentiation between lethal effect of the spray and control value of the spraying, and the importance of time of application is made very clear.

[TO BE CONTINUED.]

The Animal Parasites of Domesticated Animals and their Control.

By F. H. S. ROBERTS, M.Sc., Entomologist, Animal Health Station, Yeerongpilly.

PARASITISM occurs in both the plant and animal kingdoms, and may be regarded as a type of existence in which one organism—the parasite—is wholly or partly dependent upon another organism—the host—for food and, sometimes, shelter.

Of the many animals whose mode of life might possibly be included under this definition a good number are predaceous, and it is therefore necessary to distinguish between those which are predaceous and those which are parasitic. The demarkation between these two types of existence is at times ill defined, but it may be said that the predaceous animal lives free and, by means of the special cunning and prowess with which it is equipped, is able to snare and capture its prey; whereas the true parasite, in the lazy existence it leads, has no need of these special senses so highly developed in the predaceous animal. Those animals which are predaceous, moreover, devour their prey either whole or piecemeal. The parasite, on the other hand, as a rule, cannot exist once its host is destroyed, and its relations with the host are such that in order to obtain food and shelter from the host its endeavour is to keep the host alive. The praying mantis which captures and feeds on other insects is predaceous, while the various species of lice are parasitic.

Almost every group in the animal kingdom contains species which are parasitic. The range of parasitism extends from associations between host and parasite, in which the parasite may not only do no harm to the host but even at times give certain benefits in return for the food and shelter provided, to associations in which the parasite is distinctly injurious. This latter may be considered as true parasitism.

Such parasites may visit the host only at such times as they require food, and are known as temporary parasites. Bed bugs, fowl ticks, march flies, and mosquitoes are all temporary parasites. Others are dependent on the host not only for food but also for shelter, and are called permanent parasites, such as lice, the sheep ked, the spider or louse flies, and the various species of parasitic worms.

A convenient classification of parasitic animals may be made, depending on whether the parasite exists on the body surface or inside the body. Those found on the body are called external parasites, in contradistinction to which those feeding inside the body are known as internal parasites. Lice, biting flies, &c. are all external parasites while bots and worms are examples of internal parasites.

EXTERNAL PARASITES.

External parasites are all arthropods, or animals possessing six or eight legs. Only a few species of this group are parasitic, however, and, so far as the domesticated animals are concerned, only the *Insecta,* which contains the insects and the *Arachnida,* in which the ticks and mites occur, contain species which are associated with a parasitic life.

INSECTS.

An insect may be readily recognised by the three pairs of legs and by the division of the body into a distinct head, thorax, and abdomen.

The head usually bears a pair of antennæ. The thorax always possesses three pairs of legs and, in most cases, one or two pairs of wings.

With the exception of the bot flies, parasitic insects are external parasites. The parasitic species are confined to the three orders, *Diptera* or true flies, *Anopleura* or lice, and *Siphonaptera* or fleas.

True Flies.

True flies have only one pair of wings, the second pair found in other orders of insects being represented by a pair of rudimentary structures—the balancers. In some parasitic forms the wings may be entirely wanting. The mouthparts are constructed to form a sucking tube which in the parasitic species is modified for piercing purposes as well, enabling the insect to penetrate the skin of the host and suck up the blood and fluids.

The parasitic members of this order include mosquitoes, sandflies, march flies, the stable fly, the buffalo fly, and the spider or louse flies.

Lice.

These are generally small, flattened insects, always without wings, and with some or all of the legs provided with claws. All the members of this order are parasitic in habit.

Lice are divided into two groups—the biting lice (*Mallophaga*) and the sucking lice (*Siphunculata*).

Biting lice have a broad, flattened head which is usually wider than the thorax. The mouthparts are located on the under side of the head and are constructed for biting and chewing only. Biting lice feed on the hair, scales, skin, and feathers, or on such scabby or scurfy material as occurs among the hair or feathers of the host. They do not suck blood or live on blood in any way except when it occurs on the skin surface through the host biting or scratching itself. Biting lice are most usually to be found on birds, though nearly all domesticated animals harbour some species.

Sucking lice are usually larger than biting lice, and the head is elongate and pointed. In this sub-order the mouthparts are of the piercing and sucking type, and the louse lives on the blood and fluids of the host. Sucking lice are found on mammals only, and are not known to occur among birds.

Fleas.

The members of this order have the body compressed laterally, and are usually very small in size and dark brown in colour. The mouthparts are adapted for piercing and sucking, and the insect lives on blood. There are no wings. The legs are well developed, especially the posterior pair, which are long, powerful, and adapted for leaping which is the normal mode of progression among these insects.

The adult flea spends most of its lifetime upon the host, but the other stages in the life cycle occur off the host and usually in the soil or other suitable places.

The Life Cycle of Parasitic Insects.

Among the parasitic insects two distinct types of life cycles are observed. In the case of lice the female glues her egg to the hair or

feathers of the host. In time this egg hatches to give rise to a tiny louse not unlike the parent in general appearance but much smaller in size and not sexually mature. After feeding for some time the small louse casts its skin, and the second phase in the life cycle is reached. This is larger in size and more like the adult in appearance. Further moults or skin castings take place, and eventually the sexually mature adult appears.

With the flies and fleas, on the other hand, the egg hatches and a small elongate segmented larva appears. This stage feeds and grows and, in time, forms the "pupa" which may lie motionless in the soil or be actively swimming, as in the case of mosquitoes. When the larva is fully grown it shrinks and the outer larval skin hardens and usually turns brown. In this pupa the larval tissues are broken down and reformed to produce the adult fly which, in time, emerges and commences its life. Thus there are four stages, each of which is entirely different to the others, namely, the egg, larva, pupa, and adult.

ARACHNIDA.

This group includes, besides the mites and ticks, the spiders and scorpions as well. They are distinguished from insects by the adult's four pairs of legs, the insect having only three pairs. In the spiders and scorpions the body is divided into two distinct portions one of which is the abdomen. The other division is known as the cephalothorax, and is formed by the fusion of the head and thorax.

In the mites and ticks the head, thorax, and abdomen are so fused together that there is no distinct division of any sort. It is only these two groups which contain parasitic species.

Ticks.

All ticks are parasitic and are to be found on a very wide range of animals. In general these are flattened and oval in appearance, and on engorgment with blood may attain a very conspicuous size. The mouthparts are usually placed at the narrower and anterior end, and consist of a pair of mandibles which enable the tick to pierce the skin of the host. Once the skin is pierced a club-shaped structure with rows of recurved teeth is then inserted. This maintains the tick in position and allows it to hang free on the body. Ticks suck blood, preventing its coagulation by injecting an anti-coagulating fluid into the wound.

The life cycle of the tick is very similar to that of the louse in that a series of moults are required before the adult stage is reached. The eggs are always laid in some sheltered spot on the ground. The young tick that emerges is peculiar in having only three pairs of legs in comparison to the adult's four pairs. The larva, on finding its host, engorges and then moults to form the nymph. This stage then, in turn, engorges and moults, sometimes to give rise to a further nymphal stage, but more usually to the adult. The moults may occur on the ground or on the host, in the former case, the new phase finding a new host in the manner of the larva.

Mites.

The great majority of mites are free living. Many species are injurious to economic plants; some are predaceous and the number parasitic on animals is comparatively small. These parasitic species are

very minute in size, the largest of them being no bigger than a pin's head. They differ from ticks in many ways, but are readily recognised by their small size and the absence of the holdfast structure with its recurved teeth so characteristic of ticks. Some species live on the surface of the skin, others beneath the skin, in most cases a mange condition arising as a result of the irritation.

Here, also, there are egg, larval, nymphal, and adult stages, as in the case of ticks, but with few exceptions the whole life cycle is spent on the host. Some species—our scrub-itch mites, for example—are parasitic only in the six-legged larval stage, the remaining stages in the life cycle being generally predaceous.

INTERNAL PARASITES.

With the exception of the bot flies, whose larvæ are found in the nasal cavities of sheep, in the stomach of horses, and, in other countries under the skin of cattle, internal parasites consist almost entirely of worms, or *Helminths.* These may be readily divided into Flatworms and Roundworms, the Flatworms comprising the flukes and tapeworms.

FLUKES.

The flukes, or *Trematoda,* are generally flattened, leaflike, or sometimes conical worms. Suckers are always present, but vary in size and position according to the species. At the anterior end is the mouth which is surrounded by the oral sucker. There is a modified digestive system present, but rather peculiarly there is no anal opening. With few exceptions flukes are true hermaphrodites, and each individual may contain a complete set of both male and female genital organs. Flukes may occur in the alimentary canal, liver, lungs, and various other parts of the body.

Life History of Flukes.

The eggs reach the exterior in the body excretions—usually the dung. Here, under suitable conditions, they hatch into a small motile organism which must then bore its way into a snail before any further development can take place. After some time spent in the snail it is usually then ready to infect its host and, breaking out from the snail, reaches the open and is swallowed by the host in food or water. The snail is known as the intermediate host. In some species a second intermediate host is required.

TAPEWORMS.

Tapeworms, or *Cestodes,* as their popular name implies, are like a piece of tape in appearance, being elongate and flat. The body consists of a chain of segments which becomes very narrow towards the anterior end, which bears the very small head. Some species may attain a length of 25 feet or more, and others are so small as to be seen with difficulty with the naked eye. The head is usually provided with suckers, and is sometimes furnished with hooks, both of which enable the worm to attach itself to the wall of the intestine. There is no digestive system in the sense of a mouth, intestine, &c., the food being absorbed by the body surface. Each segment is an entirely separate identity so far as its sexual life is concerned, being provided with both male and female organs. Tapeworms usually occur in the intestine, and only a very few species are found in other parts of the body.

Life History of Tapeworms.

Of the many hundreds of species of tapeworms that have been recorded from different hosts, the life histories of very few are completely known. In all these instances, with only a single exception, an intermediate host is required to complete the life cycle. As an example, the life history of the hydatid tapeworm may be considered. The adult hydatid tapeworm is found only in the small intestine of the dog and other closely related animals such as the wolf. The dog is known as the primary host. The eggs of this adult tapeworm reach the exterior in the fæces of the dog, and in some way or other are swallowed by man, sheep, cattle, &c., all of which are intermediate hosts. The egg hatches in these intermediate hosts and gives rise to a tiny larva which then makes its way to various parts of the body, usually the liver or lungs. In these organs it then develops into a bladder-like object containing fluid. This is the larval tapeworm. No further changes take place in the intermediate host, but if organs containing these bladders are fed to the dog the adult tapeworms eventually appear in the small intestine. In this case it has been shown that many animals may act as suitable intermediate hosts but, with other tapeworms, the intermediate host range may be limited to one or very few—the beef tapeworm of man, for example, has only one intermediate host, the larval stage being found in cattle.

ROUNDWORMS.

Roundworms, or *Nematoda,* are elongate and round. There is a mouth and intestine, and the sexes are usually separate, there being male and female worms. Of the many thousands of roundworms known the majority are free living; some species do serious damage to plants and others are parasitic in animals.

Life History of Roundworms.

Like flukes and tapeworms, roundworms cannot multiply and increase inside the body, and their numbers in a host can only be augmented by the host taking in the infective stage which occurs outside the animal.

The female roundworm produces eggs or larvæ which reach the exterior principally in the fæces. Under suitable conditions the egg may develop into an infective stage, when it contains a tiny worm, or the egg may hatch outside the body, and the larva, after a certain period of development becomes infective. The infective stage, whether egg or larva, on gaining access to a suitable host, grows to the adult stage. In other cases an intermediate host is necessary, the egg or larva in the dung being eaten by a beetle or a fly or some other small animal, the adult form being reached only when the beetle, &c., is eaten by a suitable host.

THE HOST RANGE OF PARASITES.

In the case of such temporary parasites as march flies, mosquitoes, sand flies, &c., a large number of different kinds of animals act as suitable hosts. The various species of ticks usually favour one kind of animal on which they find conditions most suitable for their development, but may occasionally attack and live on other animals. The majority of the many kinds of ticks usually get their popular name from the animal on which they most frequently are seen. Thus we have the cattle tick, the dog tick, the kangaroo tick, &c. But the cattle tick sometimes occurs

on horses, sheep, and dogs, and the dog tick on cattle and cats, and so on.

Mites and lice, however, appear more restricted, and, as a rule, can exist and increase only on the one species of host. The various mange mites may transfer themselves from one species of animal to another and, although they may live for some little time on the second animal, do not succeed in establishing themselves. Similarly, with perhaps only one or a very few exceptions, the lice that occur on one animal are never found infesting a different species of animal.

In the case of worms it may be said that unless the animals are closely related species it is unusual, under natural conditions, to find the worms of one host species occurring in another. The worms found in sheep, for example, are frequently observed in cattle and goats, but do not infest horses or pigs. Poultry worms are restricted to poultry, and probably some of the species of wild birds, and never occur in pigs, &c. Similarly, it is most unlikely that our marsupials would play any great part as hosts and distributors of the worm parasites of any of our domesticated animals.

THE ECONOMIC IMPORTANCE OF PARASITES.

Generally speaking a few parasites cause little harm to the host, but when the infestation is heavy serious disturbances to the health of the host may result.

External parasites pester and irritate. They may not only considerably weaken the host through the loss of blood, but their presence results in a loss of nervous energy with a consequent interference with nutrition. Heavily infested animals will not fatten, and young animals may remain stunted.

External parasites are also important as vectors or carriers of the organisms of serious diseases. The fowl tick, for example, may transmit fowl tick fever, and the cattle tick cattle tick fever. Mosquitoes carry malaria and fleas carry bubonic plague. Others act as intermediate hosts for harmful worm parasites, one of the best examples being the mosquito which carries the larvæ of *Wauchería bancrofti,* the cause of filariasis in man.

The effect of internal parasites upon the host depends not only upon the numbers present but also upon the tissues infested and the habits of the species. Those species lying free in the alimentary canal are, comparatively speaking, the least harmful. These may rob the host of food, cause mechanical obstructions, and irritate the lining of the stomach and intestines. Blood-sucking species are distinctly harmful, and may produce an acute anæmic condition. Then there are species which invade and destroy tissues vital to the host's wellbeing, resulting in a stunted and unthrifty animal. All worms, moreover, are considered to produce toxins which are highly poisonous substances and which may be absorbed into the host's body with serious effects.

THE CONTROL OF PARASITIC INFESTATIONS.

The control of any parasitic disease involves three distinct steps—

(1) A knowledge of the various symptoms of parasite presence and of the species of parasite concerned;

(2) The application of an efficient method of treatment; and

(3) The adoption of certain measures to prevent reinfestation or to keep it below the point at which it becomes harmful.

(1.) Parasitic infestation is usually associated with certain symptoms which, however, do not as a rule become prominent until the infestation has become serious. These symptoms are dealt with in detail under the several species of parasites described herein.

Suspecting parasite presence from the symptoms manifested, the stockowner must now take steps to find out which species of parasite is concerned. This is important, because without such an examination an efficient treatment cannot be given. In the case of such external parasites as lice, fleas, and ticks, an examination of the skin surface makes the cause of the irritation at once apparent. With mange diseases, on the other hand, it is necessary to have skin scrapings examined at a laboratory, not only for a correct diagnosis of the disease condition, as skin diseases similar to mange in appearance are not always caused by mange mites, but also in order to obtain a correct identification of the species of mite, as the treatment depends largely on the species of mite causing the disease. Similarly, with the red mite and feather mite of poultry, a correct identification is essential for efficient treatment, for fowls infested with feather mites must be dipped, whereas red mite control does not require such treatment.

In the case of worms, also, a determination of the species causing the outbreak is necessary, for drugs which will remove hookworms, for example, are not effective against tapeworms. The method of diagnosis depends largely upon the number and value of the animals infested. With animals of relatively small value one or two of those showing pronounced symptoms should be killed and a careful examination made of all the internal organs and tissues, paying particular attention to the stomach, small intestine, large intestine and blind gut, liver, and lungs.

Should the stockowner not wish to sacrifice any animal for such an examination, he may be able to secure specimens of the parasite by carefully watching the dung, in which worms in cases of heavy infestation are sometimes passed in numbers. He may also avail himself of the assistance given by the laboratory, where by an examination of a sample of dung or other excretions the eggs or larvæ of the parasite may be detected.

It is always advisable to send in all specimens of external or internal parasites to the laboratory for a correct identification. This not only ensures that the treatment will be the most efficient available, but it is also of great assistance in enabling the laboratory worker to obtain very necessary information on the distribution, prevalence, &c., of any parasite.

(2.) For external parasite control various liquids, powders, and oils are available. For lice and ticks of cattle, horses, and sheep an arsenic solution is applied, usually in the form of a dip, though when only a relatively few animals are to be treated the solution may be used as a spray. For lice and fleas on small animals powders such as pyrethrum and sodium fluoride are suitable. Mange conditions and isolated confined lice infestations may be held in check by oils. Oils also usually form the base of repellents for lessening the severity of sandfly or march fly attack.

If carefully carried out one treatment may be depended upon to kill most if not all the parasites, but is usually not so effective against the egg. For the best results, therefore, at least two treatments are necessary. The second treatment should be delayed long enough to give these eggs sufficient time to hatch, but the interval must be such that no opportunity is given any parasite hatching from these unaffected eggs to reach maturity and lay further eggs.

For the removal of internal parasites various drugs are available which may be administered either in liquid form or in capsules. These drugs are all poisons and great care should be given their use. No more than the recommended dose should be given, and, to avoid any possibility of mistakes in mixing or dosing, a few animals should be treated a few days before the flock or herd and carefully watched for any ill results.

There is no drug known which can be depended upon to remove all worms after a single dosing. At least two treatments should be given after an interval sufficient to permit the animal to recover completely from the first. Where the infestation is heavy and continuous full advantage of even a highly effective drug only follows many treatments made at regular intervals throughout the year.

Individual treatment will always give best results, and attempted administration of remedies in food, drinking water, and licks is not advised unless in exceptional circumstances. The treatment of every member of a flock of poultry, for example, is regarded in many quarters as costly and impracticable, and here mass treatment by means of drugs in the food is frequently recommended.

Starvation for some time before the drug is administered is usually necessary. This allows better contact of the drug with the worm which would otherwise be protected to a large extent by the partly digested food.

(3.) Treatment is of little value, no matter how effective, so long as the animal can readily become reinfested. In the case of the worm parasites, it has already been pointed out that these cannot breed and increase inside the animal, and that the only way in which an animal can become infested is from the soil, water, or some intermediate host infected with a phase in the life history spent outside the animal. As this external phase originates in the body excretions, usually in the dung, worm parasite control can only be accomplished by cleanliness and sanitation. This is especially desirable in the case of such closely confined animals as poultry, pigs, and horses. As a rule, also, the free-living stages cannot develop in the absence of moisture. Therefore, regular removal of all dung, dry, clean conditions, and the adoption of measures to keep all food off the contaminated ground are essentials for worm parasite control.

Where animals such as sheep and cattle are concerned the draining and rotation of pastures and burning-off at certain times of the year is advisable.

Another control measure which may sometimes be adopted is the spelling of land for such a period that the free-living stages will have all succumbed.

When it is pointed out that efficient drugs are known only for a comparatively few species of the many worms that occur in domesticated

animals preventive measures assume an extremely important position, and the stock owner should take every step to see that they are observed so far as practicable.

Sanitation is also necessary for external parasite control, for not only is it concerned with the breeding places of such pests as fleas and mosquitoes but it also prevents to a certain degree the spread of lice and mites.

As young animals are more readily affected by parasite presence than old animals special care should be taken in the application of any measure which will prevent infestation to any extent. They should always be kept away as much as possible from the older animals and the contaminated ground on which these have been running.

Finally, it may be said that as nutrition probably plays an important part in the ability of the animal to resist the effects of infestation some thought should be given this phase of control. It has been found, for example, that in the case of sheep top-dressing of the pastures and the provision of suitable licks will enable the sheep to resist worm infestation to a conspicuous extent.

QUEENSLAND SHOW DATES, 1934.

July.

Bowen, 4th and 5th
Gatton, 4th and 5th
Kilcoy, 5th and 6th
Ayr, 6th and 7th
Townsville, 10th to 12th
Woodford, 12th and 13th (Sports only)
Rosewood, 13th and 14th
Cleveland, 13th and 14th
Cairns, 17th to 19th
Charters Towers, 18th and 19th
Caboolture, 20th
Barcaldine, 24th and 25th
Nambour, 18th and 19th
Atherton, 24th and 25th
Esk, 27th and 28th
Pine Rivers, 27th and 28th

August.

Royal National, 6th to 11th
Home Hill, 31st August and 1st September

September.

Enoggera, 1st
Imbil, 7th and 8th
Ingham, 7th and 8th
Pomona, 12th and 13th
Innisfail, 14th and 15th
Mareeba, 20th and 21st
Beenleigh, 20th and 21st
Rocklea, 22nd
Malanda, 26th and 27th
Kenilworth, 29th

October.

Southport, 5th
Millaa Millaa, 5th and 6th
Tully, 12th and 13th

The Determination of Larval Instars and Stadia of Some Wireworms (Elateridæ).

By W. A. McDOUGALL, Assistant Entomologist.

SOME three years ago the writer visited Mackay in order to undertake a comprehensive investigation of the wireworm pests of sugar-cane in Central Queensland. This investigation had not proceeded far before it was realised that it was necessary to have more exact information than was available on methods of determining the larval instars of wireworms, as a means to determining, in turn, the larval stadia. Considerable attention was accordingly given to this work. In the course of the past three years, over thirty different species of Elaterid larvæ have been collected in the area embraced by the investigation. Of these species, one was taken from the rotted wood on the damp lee-side of a tree stump, another from under bark, but the remainder were soil inhabitants. The wood-inhabiting species, and three of the soil species, were of the brown cylindrical type of larva with the ninth abdominal segment either simply rounded at the apex or gradually tapering to a point. Of the remaining species, all were of the yellowish semi-flattened Elaterid larval type with specifically shaped ninth abdominal segments with processes. Included in this latter group is *Lacon variabilis* Cand.; as this species is considered (9) to be the most serious wireworm pest of sugar-cane in the areas mentioned, its life cycle and habits have been observed in as much detail as possible. At the same time, the methods employed in the study of its life cycle and habits have been applied to those of other Elateridæ (mainly, but not exclusively, species of the same larval type that inhabit cultivated fields) for the purpose of checking the reliability of these methods, and also for comparing and contrasting the larval periods and general behaviour of these species with *L. variabilis.*

A. HISTORICAL.

Although the larvæ of a number of Elateridæ of economic importance have been studied, there are few published accounts of a detailed nature dealing with the length of the complete larval period or with larval instars and their stadia. Many of the workers, such as Graf (6) and Ford (5), have had to deal with pest species of wireworms which evidently require two to five or more years from egg to pupation, according to the particular species. The lengths of the larval periods have usually been estimated from observations, chiefly on the sizes of the larvæ found in the field at different times of the year, and the observed rates of growth of some of the different sized larvæ in captivity. The number of larval instars of any species has never been accurately ascertained, and very few species have been taken through from egg stage to adult.

From a survey of literature relevant to this phase of "wireworm" work, it appears that larval length is the usual criterion upon which the larvæ of any species are differentiated into groups, and this grouping is as far as most investigators have proceeded. Ford (5), after working with *Agriotes obscurus* Linnaeus, stated that many of the smaller stages

taken in one year, from July to October, varied much in size, and it was found that after about two months a number of these apparently small specimens were really of medium size. It therefore appeared to him that the breadth might be a safer criterion of age than length. Graf (6), although not successful in working out the number of larval instars of *Limonius californicus* Mannh. on account of the unsuitability of the available rearing apparatus, found the increase in the width of the head to be the best indication of an ecdysis.

Various authors have made observations on the growth rates of some species of Elaterid larvæ at different stages during larval life. Graf (6) found there were indications that *L. californicus* moulted five or six times during a larval life calculated to extend a trifle over three years. Larvæ grew rapidly during the first two or three weeks after emerging from the eggs, but this was the only time during their long larval period when growth was apparent. To Veitch (17), the moults of *Simodactylus cinnamoneus* Boisd. appeared to be of frequent occurrence and, in the older wireworms in the laboratory, they might be expected to occur once every eight to twelve weeks. The complete larval life was considered to extend over two or three years; growth rate of the young wireworms was found to be very slow. Ford (5) thought the larvæ of *Agriotes obscurus* passed through three stages, limited by three moults, and were full grown at the end of three years. There is then a period of active feeding, followed by a quiescent condition and terminating in pupation; total length of larval period was computed at four years. The rate of growth was found to be so uniform as to suggest that the curve of growth would be fairly continuous rather than irregular. Roberts (15) found *Agriotes* spp. to moult twice a year, and the rate of growth of the first stage larvæ to be very slow. The earlier estimate of five years for the larval stage of *A. obscurus* is considered to be approximately correct. Mesnil (11), who studied a number of wireworms in France, found that all seemed to have lengthy larval stages, and the larval period of *A. sputator* L. was calculated to be three years. The growth rate of the earlier instars was found to be extremely slow. Fenton (4) found that the growth of two species of *Melanotus* was very slow during the first year of larval life and that, during that time, one moult took place. Conradi and Eagerton (3) give the average periods occupied by the different stages of *Monocrepidius vespertinus* Fab. as twelve days for the egg, 305 for the larval, and thirteen for the pupal stages. In Hawaii (16) *Monocrepidius exsul* is thought to have a larval period of one year or more. Unfortunately no references are made to the growth rates of any of the larval instars of these two *Monocrepidius* species.

B. DETERMINING LARVAL INSTARS.

Various possible criteria for the grouping of larvæ of *Lacon variabilis* were investigated during the course of the rearing work with a view to enabling definite determination of instars. These included the following:—

1. Length of larvæ.
2. Greatest width of ventral mouth parts.
3. Antennal segment ratios, and other mouth part measurements.
4. Width of head capsule.

5. Time of feeding of an instar.
6. Appearance of an instar prior to an ecdysis.
7. A peculiarity in the shape of the first instar.

The results which were obtained are discussed under these headings, and this is followed by a brief discussion of Dyar's Law in its application to the larvæ of *L. variabilis*. A short account is also given of similar work which was carried out to some extent with the other species found.

During the last three quarters of 1931 approximately 1,200 larval specimens of *L. variabilis* were taken from cane fields; of these 306 were used for rearing purposes, and 219 adults were obtained from them between October and the end of that year.

Length of Larvæ.

Numerous measurements of length were taken at monthly intervals during the rearing of the larvæ (Table I.), but apart from serving as a general guide to the probable stage of development they were of little value. The chief result accruing from this rearing work was the correlation of the larva with its correct adult. After length measurements had failed to provide a method for the working out of the details of the larval life with the degree of precision desired, further search was made for criteria suitable for the purpose, as outlined.

Greatest Width of Ventral Mouth Parts.

The ventral portion of the mouth parts of an Elaterid larva is a conspicuous structure situated in a large depression on the venter of the head Plate 1, figs. A and B).

This structure is formed by the fusion of the stipites of the maxillæ with the mentum (Plate 1, fig. E [a]). In some genera (e.g., B. sp.) the mentum is quadrilateral and much longer than wide; in these instances more of the cardines are visible when the whole of the ventral mouth parts is retracted than is so with *Lacon* spp. and *Heteroderes* spp., each of these possessing a triangular mentum. A total of 229 larvæ of different sizes was examined, and it was found that these could be grouped according to the greatest width of the ventral mouth parts, i.e., the measurement (A-B) illustrated in fig. A of Plate 1. In a number of instances this grouping (Table II.) disagreed with the grouping as obtained when the same larvæ were separated on the basis of length. The groups obtained by this means were well defined, there being no individuals with intermediate measurements which might equally well be placed in two groups. During 1931 several larvæ, which had just shed their skins, had been preserved with the exuviæ which had been found near them. The (A-B) [b] measurements of the mouth parts of these larvæ and their respective exuviæ were taken, in the manner described above. Each exuvium measurement was within the limits of the group immediately preceding that into which a similar measurement of the correctly-related larva fell.

(*a*) This drawing represents one section of a complete serial section of a sixth instar. The block was prepared by the double embedding in celloidin and paraffin (adapted from Guyer: Animal Micrology, Revised Edition, p. 64) of the instar immediately after ecdysis; the larva was completely white with the exception of the tips of the mandibles, which were brown.

(*b*) For the sake of convenience the greatest width of the ventral mouth parts is termed the (A-B) measurement both in the text and tables.

TABLE I.

LENGTHS OF LARVÆ IN CENTIMETRES; DATA BASED ON THE RECORDED OBSERVATIONS ON 306 LARVÆ AND 3 PUPÆ, MADE DURING REARING WORK, 1931.

Lab. No. of Larva and Pupa.	Dates of Observations.										
	14th May	8th June	22nd June.	6th July.	5th Aug.	9th Sept.	28th Sept.	Oct.	Nov.	Dec.	Jan. (1932).
P. 2 ..	P.f.		Adult 19th May.								
L. 2 ..	Length ·58 cm.	p.n.c. n.e.	p.n.c. n.e.	p.n.c. n.e.	p.n.c. n.e.	e. Ex. f. ·9 cm.	e. Ex. f. 1·2 cm.	..	Adult (17th)	..	..
L. 19 ..	1·45	p.n.c. n.e.	1·7	e.h. 1·6	n.e. 1·7	e.h. 1·9	n.e.	n.e.	P.f. (17th) Adult (29th)	..	..
L. 23 ..	1·1	p.n.c. n.e.	p.n.c. n.e.	p.n.c. n.e.	n.e. Ex. f. 1·1	e.h.	e.h. Ex. f. 1·5	n.e. 1·7	P.f. (17th) Adult (24th)	..	..
L. 31 ..	1·0	n.e. Ex. f. 1·4	p.n.c. e.h.	n.e.	n.e.	e.h. Ex. f. 1·5	n.e.	n.e.	P. f. (17th) Adult (30th)	..	..
L. 40 ..	1·5	e.h. 1·6	p.n.c. n.e. 1·74	p.n.c. n.e.	p.n.c. n.e.	p.n.c. n.e.	p.n.c. n.e.	P.f. (12th) Adult (21st)	..	..	..
L. 47 ..	1·9	p.n.c. e.h. ..	p.n.c. n.e.	p.n.c. n.e.	Just changed Ex. f.	e.v.h. 1·86	e.h. Ex. f. 1·94	..	P. f. (17th) Adult (22nd)	..	..
L. 52 ..	1·1 ..	p.n.c. n.e.	p.n.c. n.e.	..	p.n.c. n.e. 1·1	e.v.h. 1·4	p.n.c. 1·5	e.h. Ex. f. 1·7	P.f. (17th) Adult (21st)	..	..
L 70 ..	·77	e.	..	..	Ex.f.	e.h. 1·2	e.h. 1·3	e.h. 1·6	p.n.c. n.e.	P.f. (27th)	Adult (8th)
L. 81 ..	1·9	e.v.h. Ex.f.	n.e. p.n.c. 1·9	p.n.c. n.e.	p.n.c. n.e.	p.n.c. n.e.	In a cell	P.f. (12th) Adult (17th)	..	..	..
L. 87 ..	·83	h.e. Ex.f. 1·0	p.n.c. n.e.	n.e.	n.e.	e.v.h. 1·6	1·7	e.v.h.	P.f. (17th) Adult (29th)	..	..

L. 88 ..	1·9	Just changed Ex.f.	e.v.h. 1·9	n.e.	n.e.	n.c.	n.e.	1·8	..	P.f. (8th) Adult (10th)	..
L. 95 ..	1·7	e.v.h. Ex.f. 1·9	1·9	n.e.	Just changed n.e. Ex.f.	e.v.h.	2·0	..	P.f. 2nd Adult (15th)	..	..
L. 120 ..	Taken from field 27th May 1·6	..	e.v.h. Ex.f. 1·6	1·9	..	Nearing an ecdysis	e.v.h. 1·9	..	..	P.f. (3rd) Adult (8th)	..
Ls. 140 to 145		..	.. ..	Taken 10th July 1·7	p.n.c. n.e.	.. ..	..	1·6 to 1·7	..	P.f. (17th) Adults (20th to 25th)	..
L. 152 ..	..	..	..	1·3	Ex.f. 1·5	e.v.h.	Ex.f. 1·6	e.v.h.	..	P.f. (10th) Adult (21st)	..
L. 161 ..	..	..	..	1·9	p.n.c. n.e.	p.n.c. n.e.	p.n.c. n.e.	p.n.c. n.e.	P.f. (2nd Adult (10th)	..	..
L. 205 ..	.. ..	..	..	1·9	p.n.c. n.e.	e.v.h. Ex.f. 2·0	..	..	P.f. (2nd) Adult (10th)	..	..
L. 230 ..	..	..	..	2·1	p.n.c. n.e.	p.n.c. n.e.	p.n.c. n.e.	..	Adult (17th)	..	..
L. 255 ..	..	..	..	Taken 27th July very small	e.h.	1·3	e.	e. 1·6	e.v.h. Ex.f. 1·6	e.v.h.	P.f. (8th) Adult (10th)
L. 256 ..	..	..	..	Very small	e.h.	1·0	e.	e.v.h. 1·45	e.v.h.	P.f. (18th) Adult (20th)	..
Ls. 295 to 301	..	..	..	..	..		..	Taken 14th Oct. 1·6—2·1	Adults (17th-28th)	..	..

p.n.c. = probably no change; n.e., e., e.h., e.v.h. = not eaten, eaten, eaten heavily, or eaten very heavily, of potato tuber since last inspection (fresh potato tuber supplied after every inspection). Ex.f. = exuvium found; P.f. = pupa found.

TABLE II.—MOUTH PART MEASUREMENTS OF SIX GROUPS OF LARVÆ.

Group.	Number of Larvae Measured.	Greatest Width of Ventral Mouth Parts. (in mm.)		
		Minimum.	Mean.	Maximum.
A	5	·35	·38	·40
B	10	·47	·52	·54
C	68	·63	·68	·70
D	60	·79	·83	·86
E	29	·96	·99	1·03
F	57	1·12	1·15	1·24
Total	229	..	..	..

In December, 1931, and January, 1932, approximately 1,000 eggs of *L. variabilis* were obtained from adults bred from larvæ during 1931 and from other adults collected in the field. From these eggs many larvæ emerged and were used for rearing purposes. With the rearing apparatus in use at that time the majority of the exuviæ from the younger instars could not be recovered from the soil in the rearing jars. However, the (A-B) measurements of 179 small instars were taken; at the time of measurement some of those larvæ had just emerged from eggs. Again, grouping could be effected, and the details are given in Table III.; obviously groups J and K contain larvæ similar to those represented by groups A and B respectively of Table II. It would seem, therefore, that any larva of *L. variabilis* can be placed, according to its (A-B) measurement, into one of eight groups.

TABLE III.—MOUTH PART MEASUREMENTS OF FOUR GROUPS OF LARVÆ.

Group.	Number of Larvae Measured.	Greatest Width of Ventral Mouth Parts. (in mm.)		
		Minimum.	Mean.	Maximum.
G	89	·161	·163	·167
H	50	·21	·23	·28
J	27	·35	·38	·40
K	13	·47	·53	·54
Total	179	..	..	..

The percentage loss by death in rearing young larvæ up to the fourth group (Group K of Table III.) was exceptionally heavy during 1932. Varying environmental conditions were tried, and when a suitable set of conditions was found, 134 larvæ were reared from eggs to

TABLE IV.

(A–B) MEASUREMENTS AS DETERMINED FROM THE RECORDED OBSERVATIONS OF 134 LARVÆ.

Laboratory No. of Larva.	Egg Laid.	First Instar.		Remarks on any Intermediate (A–B) Measurements and Ecdyses.	Ecdyses Observed.														Date of Appearance of Adult.	Length of Complete Larval Period (in days).
		Date of Emergence.	(A–B) Measurement.		Date.*	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.*	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.*	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.*	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.*	(A–B) Measurement of Exuvium.		
L1. 1	8 i.	16 i.	·163	Larvæ with (A–B) measurement of ·65 on 8 iii.	..	..	..	12 iii.	·65	·79	29 iv.	·79	·98	1 vi.	·98	1·14	1 x.	1·14	16 x.	259
L1. 3	8 i.	16 i.	·162	Larvæ with (A–B) measurement of ·54 on 16 ii.	20 ii.	·54	·67	8 iii.	·67	·84	1 v.	·84	1·03	21 vi.	1·03	1·24	30 x.	1·24	14 x.	288
L1. 6	8 i.	16 i	·166	Found on 24 ii. an exuvium with (A–B) measurement of ·35; on 27 ii. (A–B) measurement of larvæ was ·47	2 iii.	·47	·63	10 iv.	·63	·79	25 v.	·79	·98	29 vii.	·98	1·20	1 xi.	1·2	16 xi.	290
L2. 2	10 i.	18 i.	·167	..	..	..	..	25 iv.	·65	·82	6 vi.	·81	·98	4 vii.	·98	1·16	23 xi.	1·16	7 xii.	310
L2. 3	10 i.	18 i.	·161	Larvæ with (A–B) measurement of ·53 on 18 ii.	19 ii.	·53	·67	4 iii.	·67	·84	15 iii.	·84	(Pupa)	..	..	..	..	..	29 iii. ♂	57
L2. 5	10 i.	18 i.	·163	..	..	..	..	24 ii.	·65	·80	4 iii.	·81	·98	..	..	..	26 iii.	1·16	9 iv. ♀	68
L2. A1	28 i.	6 ii.	·167	Two ecdyses recorded. (A–B) measurement 12 iii. (Ex. ·26) (L. 39); 28 iii. (Ex. ·39) (L. 51)	30 iv.	·51	·65	4 vi.	·66	·81	26 viii.	·81	·98	7 x.	·98	1·12	24 xi.	1·12	10 xii.	292
L2. 26	1 ii.	9 i.	·161	Ecdyses recorded on 12 iii. (Ex. ·237) (L. ·373)	..	..	..	1 v.	·63	·82	1 vi.	·82	1·02	28 vii.	1 02	1·25	14 xi.	1·25	29 xi.	279
L22. 11	29 i.	7 ii.	·164	Larvæ with (A–B) measurement of ·51 on 28 iv.	5 v.	·51	·63	18 vi.	·63	·79	1 ix.	·79	·98	1 x.	·98	1·15	12 xii.	1·15	Found Adult, 8 ii. 1933	..
L22. 17	29 i.	7 ii.	·164	Larvæ with (A–B) measurement of ·51 on 8 iii.	20 iii.	·50	·65	10 v.	·65	·86	5 vi.	·86	1·03	20 vii.	1·03	1·20	9 i. 1933	1·20	24 i., 1933	337
L22. 18	29 i.	7 ii.	·165	Recorded an ecdysis on 20 iii. (Ex. ·25) (L. ·39)	24 i.	·51	·65	1 v.	·65	·84	1 vi.	·84	·98	30 vii.	·98	1·16	26 x.	1·16	10 xi.	262
L22. 22	30 i.	8 ii.	·163	Larvæ with (A–B) measurement of ·49 on 15 v.	25 v.	·49	·65	26 vi.	·65	·86	24 viii.	·86	·98	26 x.	·98	1·20	25 xi.	1·20	9 xii.	291
L22. 23	30 .	8 ii	·163	Larvæ with (A–B) measurement of ·49 on 1 v.	14 iv.	·49	·63	5 v.	·63	·81	6 vi.	·81	1·03	24 vii.	1·03	1·20	26 x.	1·20	9 xi.	261
L22. 26	8 ii.	16 ii.	·161	Larvæ with (A–B) measurement of ·65 on 29 iii.	..	..	..	5 iv.	·65	·82	24 v.	·82	1·03	1 vii.	1·03	1·17	28 x.	1·17	11 xi.	255
L7. A8	1 ii.	9 ii.	·161	Recorded the ecdysis (Ex. ·25) (L. ·37)	..	..	..	4 iii.	·67	·82	30 iv.	·82	·98	1 vii.	·98	1·14	14 xi.	1·14	30 xi.	279

L1. 1, L1. 3, and L1. 6 are larvæ from eggs of adult L1. L22 only, represents more than one female confined in the one cage.

* ±) 2 days; in many instances the date is exact.

TABLE V.

(A–B) MEASUREMENTS IN MILLIMETRES AS DETERMINED FROM THE RECORDED OBSERVATIONS ON 117 LARVÆ.

Laboratory No. of Larvæ.	Date when Collected from Field.	(A–B) Measurement on Date of Collection.	Ecdyses Recorded. Date.*	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.*	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.*	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.*	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.*	(A–B) Measurement of Exuvium.	Pupa.	Date of Appearance of Adult.
128	19 April	·96	..	..	..	..	..	..	..	..	..	15 May	·96	1·16	19 Dec.	1·16	..	..
169	19 April	1·17	..	..	..	..	..	..	..	..	..	..	..	..	10 May	1·17	..	25 May
132	19 April	·65	..	..	..	27 April	·65	·86	21 July	·86	1·03	21 Oct.	1·03	1·21	1 Dec.	1·21	..	17 Dec.
134	19 April	1·17	..	..	..	..	..	..	..	..	..	..	..	..	8 May	1·17	..	22 May
135	19 April	1·03	..	..	..	..	..	..	..	..	..	1 June	1·03	1·16	1 Nov.	1·16	..	16 Nov.
146	19 April	·51	25 April	·51	·70	15 May	·70	·86	1 June	·86	·98	1 July	·98	1·16	25 Oct.	1·16	..	9 Nov.
150	19 April	1·16	..	..	..	..	..	..	..	..	..	..	..	..	?	1·16	..	Found Adult, 2 June
158	19 April	·47	20 May	·47	·67	1 July	·67	·82	15 Sept.	·82	·98	15 Oct.	·98	1·15	28 Nov.	1·15	..	12 Dec.
169	24 May	·65	..	..	..	20 June	·65	·82	21 July	·82	1·00	20 Aug.	1·00	1·16	25 Oct.	1·16	..	10 Nov.
182	1 June	†·39	28 Aug.	·51	·65	12 Oct.	·65	·82	30 Oct.	·82	·98	14 Nov.	·98	1·15	28 Nov.	1·15	..	13 Dec.
183	10 June	·96	..	..	..	..	..	..	..	..	..	15 June	·96	1·14	14 Nov.	1·14	..	30 Nov.
184	22 June	1·00	..	..	..	..	..	..	..	..	..	24 June	1·00	1·26	25 Oct.	1·26	..	9 Nov.
185	22 June	1·15	..	..	..	..	..	..	..	..	..	..	..	..	5 Nov.	1·15	..	20 Nov.
186	22 June	·98	..	..	..	..	..	..	..	..	..	20 July	·98	1·16	14 Nov.	1·16	..	29 Nov.
187	22 June	·96	..	..	..	..	..	..	..	..	..	20 Aug.	·96	1·12	14 Nov.	1·12	..	28 Nov.
190	22 June	1·26	..	..	..	..	..	..	..	..	..	..	..	..	1 Oct.	1·26	..	16 Oct.
191	22 June	1·26	..	..	..	..	..	..	..	..	..	..	..	..	14 Nov.	1·26	..	28 Nov.
192	22 July	·81	..	..	..	..	..	..	1 Aug.	·81	·98	12 Oct.	·98	1·14	14 Nov.	1·14	..	29 Nov.
198	15 Aug.	·51	28 Aug.	·51	·68	15 Oct.	·68	·84	28 Nov	·84	(Pupa)	..	..	..	..	..	..	12 Dec.
199	15 Aug.	·67	..	..	..	15 Sept.	·67	·86	11 Oct.	·86	1·00	20 Nov.	1·00	1·19	12 Dec.	1·19	..	..

* (±) 2 days; in many instances the date is exact.

† Ecdysis recorded on 9 June, (A–B) measurement of exuvium being ·39 and that of larva ·51.

adults. Each larva was watched carefully, and the necessary measurements of both larva and exuvium were taken after all the later ecdyses (Table IV.). It now seems apparent that at least the last five larval instars of *L. variabilis* can be recognised by referring the measurements of the greatest widths of their ventral mouth parts to Table II. During this year (1932) larvæ in different stages were taken from the fields at intervals and reared to adults (Table V.). This was done mainly for two purposes—firstly, to obtain additional evidence along the lines utilised in Table IV.; and secondly, to compare the development of the larvæ reared in the laboratory, from eggs to adults, with those living under field conditions during various portions of their existence.

Between December, 1932, and November, 1933, with a better knowledge of the environmental conditions desired by the smaller instars, and with more suitable rearing apparatus, 107 larvæ were taken through from eggs to adults. In 49 instances a complete set of eight larval exuviæ for each specimen under observation was obtained and the larval and exuvial (A-B) measurements were recorded as in Table VIa. In other instances an occasional exuvium was missed out; however (A-B) measurements taken of all exuviæ found, and also of the related larvæ, were in accord with what would be expected after a study of the recorded observations of which a portion are set out in Table VIa. There now seems to be no doubt that there are normally eight instars in the larval life of *L. variabilis,* and that any larval specimen of this species can be given its correct "instar number" by referring the measurement, in millimetres, of the greatest width of its ventral mouth parts to the eight distinct groups of Tables II. and III.

As in previous years a small proportion of the larvæ behaved in a manner similar to No. L2.3. of Table IV., i.e., pupation was reached after less than eight larval moults, and in four instances a complete set of six larval exuviæ for each specimen was recovered. In each instance the (A-B) measurement of the final larval exuvium corresponded to that of a larva in its sixth instar. When there are only six instars during the life of a larva, any resulting adult is invariably a small male. As in 1932 observations were made on numerous specimens collected in the field; records of such are very similar to those recorded in Table V.

In compiling the tables for this article from records of observations on larvæ reared from eggs in the laboratory, no references have been made to those instances when only one or two ecdyses (with necessary measurements) were recorded of any larvæ which, for some reason or other, were not taken through to pupation. The inclusion of such records would easily double the "ecdysal" measurements similar to those of Tables IV.-VIa., and it would be merely added evidence in favour of the points which these tables already demonstrate.

Antennal Segment Ratios and Other Mouth Part Measurements.

Roberts (16), when describing the first larval instar of an *Agriotes* sp., points out that the third, or supplementary segment in an antenna is longer than the conical ventral process at the apex of the second, but that this difference is much less in the mature larvæ. At this stage it is also much longer in proportion to the whole antenna than in the older larvæ. When working with *L. variabilis* it was found to be very difficult to measure accurately the true lengths of the segments of the antennæ (see Plate 1, fig. D.). Each segment can be withdrawn,

TABLE VIA.

(A–B) MEASUREMENTS IN MILLIMETRES AS DETERMINED FROM THE RECORDED OBSERVATIONS ON 49 LARVÆ.

Laboratory No. of Larva.	Egg Laid.	First Instar.		Date.	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.
		Date of Emergence.	(A–B) Measurement.												
4	20 Nov., 32	28 Nov., 32	·162	5 Dec., 32	·162	·233	19 Dec., 32	·23	·39	12 Jan., 33	·39	·52	11 Feb., 33	·52	·65
5	20 Nov., 32	28 Nov., 32	·162	6 Dec., 32	·162	·237	18 Dec., 32	·24	·38	15 Jan., 33	·38	·52	24 Jan., 33	·52	·66
12	5 Dec., 32	12 Dec., 32	·161	24 Dec., 32	·161	·233	13 Jan., 33	·234	·40	16 Feb., 33	·40	·54	3 Mar., 33	·54	·70
26	21 Nov., 32	28 Nov., 32	·167	4 Dec., 32	·167	·235	11 Dec., 32	·24	·39	19 Dec., 32	·39	·53	1 Jan., 33	·53	·69
30	8 Dec., 32	15 Dec., 32	·165	24 Dec., 32	·165	·233	3 Jan., 33	·23	·38	20 Jan., 33	·38	·52	3 Feb., 33	·52	·67
33	5 Dec., 32	13 Dec., 32	·163	24 Dec., 32	·163	·234	13 Jan., 33	·234	·36	4 Feb., 33	·36	·52	20 Feb., 33	·52	·68
35	5 Dec., 32	12 Dec., 32	·163	19 Dec., 32	·163	·236	26 Dec., 32	·236	·38	10 Jan., 33	·38	·52	15 Feb., 33	·52	·69
37	13 Dec., 32	21 Dec., 32	·163	3 Jan., 33	·163	·233	24 Jan., 33	·233	·37	4 Feb., 33	·37	·53	21 Feb., 33	·53	·68
39	3 Jan., 33	10 Jan., 33	·163	24 Jan., 33	·163	·234	4 Feb., 33	·235	·37	21 Feb., 33	·37	·51	23 Mar., 33	·51	·66
41	3 Dec., 32	12 Dec., 32	·163	19 Dec., 32	·163	·233	25 Jan., 33	·233	·39	14 Feb., 33	·39	·53	16 Mar., 33	·53	·67
62	5 Jan., 33	12 Jan., 33	·162	24 Jan., 33	·162	·235	13 Feb., 33	·235	·38	24 Feb., 33	·38	·53	9 Mar., 33	·53	·67

TABLE VIA.—*continued.*

(A–B) MEASUREMENTS IN MILLIMETRES AS DETERMINED FROM THE RECORDED OBSERVATIONS ON 49 LARVÆ—*continued.*

Laboratory No. of Larva.	Egg Laid.	Date.	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.	(A–B) Measurement of Exuvium.	Pupa.	Date of Appearance of Adult.	Length of Complete Larval Period (in days).
4	20 Nov., 32	15 Mar. ..	·65	·82	7 May ..	·82	·98	27 May ..	·98	1·15	7 Nov. ..	1·15	..	21 Nov., 33	344
5	20 Nov., 32	18 Feb. ..	·66	·85	10 Apr. ..	·85	1·00	30 May ..	1·00	1·20	1 Nov. ..	1·20	..	15 Nov., 33	338
12	5 Dec., 32	3 Apr. ..	·69	·86	7 May ..	·86	1·00	15 June ..	1·00	1·16	10 Nov. ..	1·16	..	24 Nov., 33	333
26	21 Nov., 32	23 Jan. ..	·69	·84	4 Feb. ..	·84	·98	20 Mar. ..	·98	1·12	26 Apr. ..	1·12	..	11 May, 33	149
30	8 Dec., 32	1 Mar. ..	·67	·82	29 Mar. ..	·82	·98	11 May ..	·98	1·15	26 Oct. ..	1·15	..	7 Nov., 33	315
33	5 Dec., 32	16 Mar. ..	·68	·85	5 Apr. ..	·85	1·00	13 May ..	1·00	1·20	9 Nov. ..	1·20	..	23 Nov., 33	331
35	5 Dec., 32	12 Mar. ..	·69	·85	1 Apr. ..	·85	1·00	9 June ..	1·00	1·16	14 Nov. ..	1·16	..	28 Nov., 33	337
37	13 Dec., 32	23 Mar. ..	·68	·82	1 May ..	·82	·98	9 June ..	·98	1·16	14 Oct. ..	1·16	..	29 Oct., 33	297
39	3 Jan., 33	1 May ..	·66	·81	9 June ..	·81	·98	4 July ..	·98	1·12	4 Nov. ..	1·12	..	19 Nov., 33	298
41	3 Dec., 32	19 Apr. ..	·67	·84	10 May ..	·84	1·00	21 June ..	1·00	1·21	10 Nov. ..	1·21	..	24 Nov., 33	333
62	5 Jan., 33	25 Mar. ..	·67	·82	29 Apr. ..	·82	1·00	30 May ..	1·00	1·21	15 Nov. ..	1·21	..	30 Nov., 33	307

TABLE VIB.

Laboratory No. of Larva.	(A–B) MEASUREMENTS OF INSTARS (IN MM.).														
	1st	A	2nd	B	3rd	C	4th	D	5th	E	6th	F	7th	G	8th
4	·162	·071	·233	·157	·39	·13	·52	·13	·65	·17	·82	·16	·98	·17	1·15
5	·162	·075	·237	·143	·38	·14	·52	·14	·66	·19	·85	·15	1·00	·20	1·20
12	·161	·072	·233	·167	·40	·14	·54	·16	·70	·16	·86	·14	1·00	·16	1·16
26	·167	·068	·235	·155	·39	·14	·53	·16	·69	·15	·84	·14	·98	·14	1·12
30	·165	·068	·233	·147	·38	·14	·52	·15	·67	·15	·82	·16	·98	·17	1·15
33	·163	·071	·234	·126	·36	·16	·52	·16	·68	·17	·85	·15	1·00	·20	1·20
35	·163	·073	·236	·144	·38	·14	·52	·17	·69	·16	·85	·15	1·00	·16	1·16
37	·163	·070	·233	·137	·37	·16	·53	·15	·68	·14	·82	·16	·98	·18	1·16
39	·163	·071	·234	·136	·37	·14	·51	·15	·66	·15	·81	·17	·98	·14	1·12
41	·163	·070	·233	·157	·39	·14	·53	·14	·67	·17	·84	·16	1·00	·21	1·21
62	·162	·073	·235	·145	·38	·15	·53	·14	·67	·15	·82	·18	1·00	·21	1·21
L1. 1	..	..	..	..	..	..	..	..	..	..	·79	·19	·98	·16	1·14
L1. 3	..	..	..	..	..	..	·54	·13	·67	·17	·84	·19	1·03	·21	1·24
L 22. 11	..	..	..	..	..	..	·51	·12	·63	·16	·79	·19	·98	·17	1·15
L2. A1	..	..	·26	·13	·39	·12	·51	·14	·65	·16	·81	·17	·98	·14	1·12
L22. 26	..	..	..	..	..	..	..	..	·65	·17	·82	·21	1·03	·14	1·17
L7. A8	..	..	..	..	..	..	..	..	..	..	·82	·16	·98	·16	1·14
132	..	..	..	..	..	..	..	..	·65	·11	·86	·17	1·03	·18	1·21
146	..	..	..	..	..	..	·51	·19	·70	·16	·86	·12	·98	·18	1·16
158	..	..	..	..	..	..	·47	·20	·67	·15	·82	·16	·98	·17	1·15
169	..	..	..	..	..	..	..	..	·65	·17	·82	·18	1·00	·16	1·16
182	..	..	..	..	·39	·12	·51	·16	·65	·17	·82	·16	·98	·17	1·15
192	..	..	..	..	..	..	..	..	..	..	·81	·17	·98	·16	1·14
198	..	..	..	..	..	..	·51	·17	·68	·16	·84	..	..	..	..
199	..	..	..	..	..	..	..	..	·67	·19	·86	·14	1·00	·19	1·19

Columns headed by ordinates give (A–B) measurements of instars, whilst columns headed by the letters A, B, C, &c., give differences in (A–B) measurements of larvæ in successive instars. All measurements in millimetres.

wholly or partly, into the one preceding it and the whole antenna may be withdrawn into the head capsule. The same difficulty is encountered when attempting to measure some of the mouth parts and their appendages. The maxillary palps may telescope wholly or partly and the dististipites (Plate 1, fig. A., *dis.*) and appendages connected with them may be withdrawn into the stipites; the mentum may house the prementum. It is considered that the use of antennal segment ratios for distinguishing the different instars is attended by too many difficulties. Table VII. gives the ratios, obtained after many measurements, of the lengths of the antennal segments for all larval instars; all measurements having been brought to a common denominator.

Measurements were made of the distance from the tips of the mandible to the condyles, but quite often when the larger instars are nearing the completion of stadia, the tips of the mandibles become worn, as also do the processes of the nasale.

TABLE VII.—ANTENNAL SEGMENT RATIOS. IN THE COLUMN DEALING WITH THE SECOND SEGMENTS THE UPPER FIGURES REPRESENT THE LENGTHS OF THE SEGMENTS WHILE THE LOWER FIGURES RELATE TO THE CONICAL PROCESSES AT THE APICES OF THE SEGMENTS.

Instar.	Segments of Antenna.		
	First.	Second.	Third.
First	6	9 10	14
Second	16	15 12	16
Third	26	20 15	20
Fourth	40	28 18	24
Fifth	54	38 19	27
Sixth	70	46 20	30
Seventh	90	58 21	34
Eighth	110	68 22	40

DESCRIPTION OF PLATE 1.

Lacon variabilis Cand.

A.* Ventral mouth parts. Dis., dististipites; st., stipites; m., mentum; c., cardo × 24.

B. Ventral view of head showing ventral mouth parts *in situ* × 24.

C. Dorsal view of full-grown larva × 3.

D.* Antenna of sixth larval instar × 60.

E.* Transverse section through head region showing mentum fused with the stipites of the maxillæ. M., mentum; st., stipites; ma., mandible; a., antenna × 60.

* Drawn from permanent mounts.

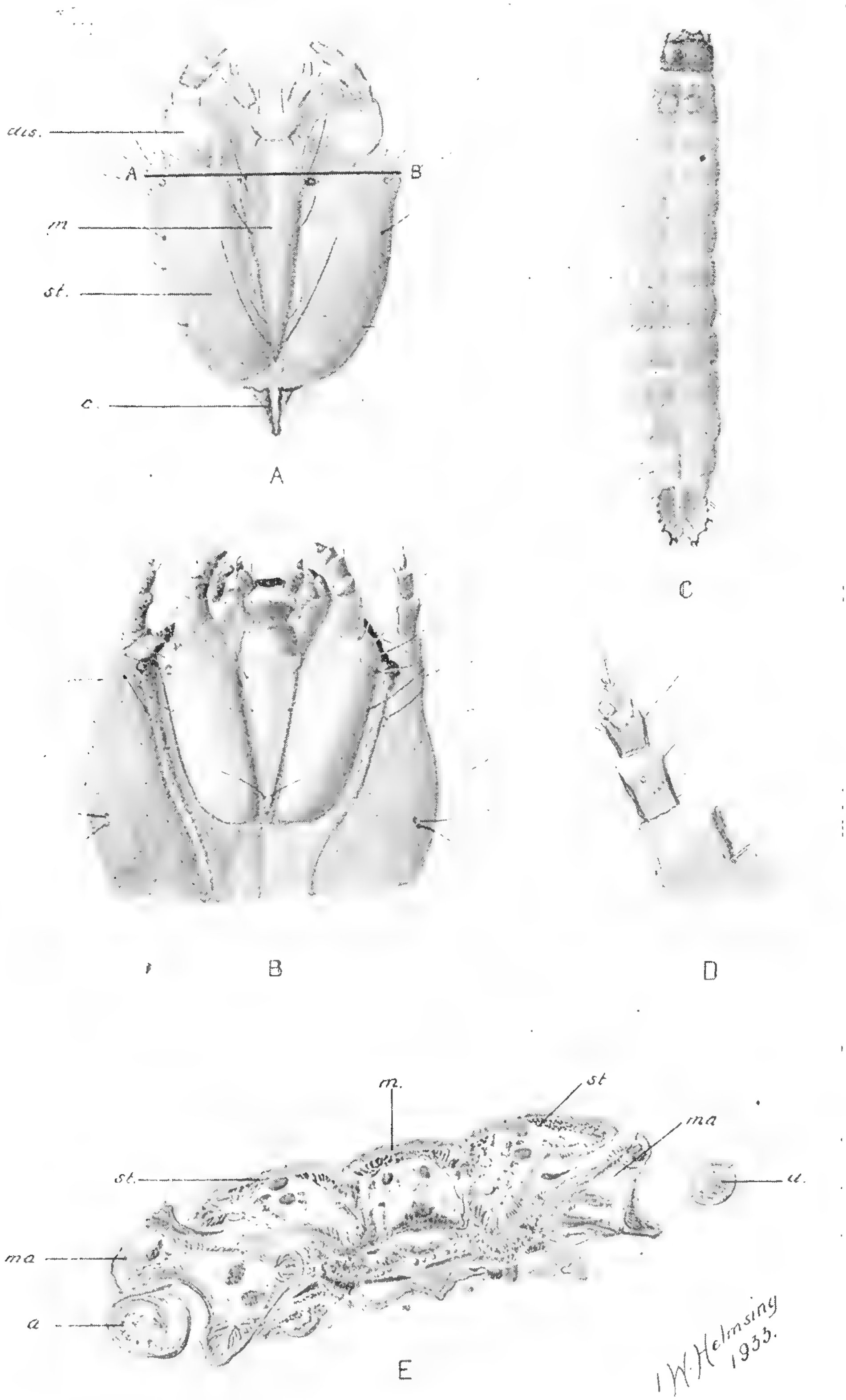


PLATE 1.

Width of the Head Capsule.

In all probability this measurement could have been utilised in determining the instars of *L. variabilis* had no other criterion been of outstanding value. Measurements of the widths of the head capsules are not as accurate as those of the ventral mouth parts, as the capsules may be ruptured during ecdyses. Furthermore, the comparatively compact nature of the ventral mouth parts (see Plate 1, figs. B. and E.) does not allow of their losing shape when being measured in exuviæ, whereas the empty moulted head capsules tend to flatten, with consequent increase of width. When dealing with living specimens, the accurate measurement of the ventral mouth parts is much more easily carried out than that of the head capsules. Measurements of the head capsules of each instar are such that, where v = greatest width of the ventral mouth parts, and h = width of head capsule, v = kh, k being a constant which closely approximates to ·60 for any specimen of any larval instar of *L. variabilis.*

Time of Feeding of an Instar.

During 1931, when length measurements only were determined, it was apparent that feeding was not continuous (see Table I.). Later it was observed that, in the continued presence of vegetable material and suitable soil moisture, a *L. variabilis* instar feeds voraciously for a short period immediately after an ecdysis and does not feed again during that stadium. As examples Nos. 4, 5, 30, and 33 of Table VIA. may be cited. Nos. 30 and 33 were in the final larval instar by the middle of May, Nos. 4 and 5 by the end of May; Nos. 30 and 33 pupated in late October and early November respectively, but both had finished feeding by the first week in June while Nos. 4 and 5 had finished feeding by the third week in June. At all times, from May to November, vegetable material and suitable soil moisture conditions were present in the jars containing the larvæ in order to encourage the feeding of this particular instar. If either of the two environmental factors governing feeding is unfavourable immediately after an ecdysis the larva will ingest soil, but if suitable conditions are provided at a later stage during the stadium, the one large feed of vegetable material will be taken. In addition to the effect on the time of feeding, variations in these environmental conditions have an effect on the measurable length of an instar.

Appearance of an Instar Prior to Ecdysis.

Prior to ecdyses all instars become torpid, their general shape and colouring changes, and in many instances the measurable length is increased. The body segments may assume the appearance of a short string of tightly-strung broad-ended beads, with indentations here and there in the lateral and ventral regions. The general colour is paler than that of the normal active larvæ. In this pre-ecdysal state a larva may exist for periods ranging from two days (smaller instars), to as long as two months (last larval instar). This distinctive appearance of the instars before ecdyses, and their heavy feeding immediately after ecdyses, when conditions are at all suitable, were of considerable help during the rearing work of 1932-33 in enabling us to place within a few days the dates of some of the ecdyses of the smaller and moderately-sized instars.

A Peculiarity in Shape of the First Larval Instar.

It was found that the larvæ of *L. variabilis* do not assume the specific shape of the ninth abdominal segment until the second instar

(see Plate 2, figs. C, D, and E), and as a result the first instar can be separated from all other larval instars on the basis of the shape of the ninth abdominal segment alone.

Discussion.

Concerning the use of head width measurements Imms (7) states:—"Dyar has shown from observations on the larval instars of twenty-eight species of Lepidoptera that the head-width follows a regular geometric progression in successive instars. Since the head is not subject to growth during a stadium it is possible, by means of accurate measurements, to determine whether ecdysis has been overlooked during life-history studies." During the past few years some workers ([a]) have attempted to apply Dyar's Law to other orders of insects, not only as a means of determining whether an ecdysis has been overlooked or not during life-history studies, but also in some instances for the purpose of estimating the number of instars in some particular species. The procedure usually adopted is to measure accurately the widths of the head capsules of a sufficiently large random population and then arrange the measurements in an ascending order of magnitude. Measurements are next divided into well-defined groups, if possible, and the mean of each group calculated. The possibility of these means advancing in geometrical progression is then investigated and as much rearing work as possible is carried out.

This procedure has been followed in dealing with *L. variabilis* with this exception, that for greater convenience and accuracy, the greatest widths of the ventral mouth parts (v) were measured instead of the widths of the head capsules (h) ($v = 0{\cdot}60 \times h$, see page 56). In Table VIII. are set out eight groups, together with means, &c., and it is demonstrated by the measurements taken during the rearing of larvæ from eggs to adults, that each group represents an instar. In compiling this table all data as shown in Tables II. and III. are used in conjunction

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(*a*) Metcalfe (12) found that the head measurements of 887 specimens of a random population of *Sitodrepa panicea* L. fell into two sets of groups, the growth ratios of which approximated to two geometric series; it is suggested that these two sets represent sexes. No satisfactory conclusions with regard to the number of early instars could be reached owing to the inadequate number of larvæ obtained.

Miles (13) found that in the Tenthredinidæ studied by him growth and development appear to be more complicated than in the larvæ of Lepidoptera first reported by Dyar. Sex differentiation is considered to render the larval growth of the later instars irregular.

Prebble (14) found that the larval growth rate of three bark-beetles conformed satisfactorily with Dyar's Law. One species has four larval instars and the other two species three.

Andrewartha (1) measured the head widths of 147 larvæ of *Otiorrhyncus cribricollis* Gyll. It was considered that the grouping of these measurements, together with some relevant circumstantial evidence, demonstrated that there are ten instars in the larval life of *O. cribricollis.* For this species Dyar's Law was found to hold good when applied to the average head width of an instar. From this work Andrewartha concludes that "we now have a reliable method for determining the number of instars in the life of soil-inhabiting, leaf-mining, and other inaccessible larvæ." The actual application of the method together with direct evidence shows that, so far as *L. variabilis* and several other species of Elateridæ are concerned, the above conclusion is not altogether correct. The application of Dyar's Law, in its entirety, to the average head width of successive instars seems to have some limitations.

with similar measurements of the larvæ represented in Tables IV., V., and VIA. From Table VIII. it will be seen that the means of the groups representing the last seven larval instars are very approximately in regular arithmetical progression with a common difference of ·15 to ·16 (theoretically ·153).

TABLE VIII.

Groups Representing the Larval Instars.	Observed. A-B Measurements in mm. Minimum.	Observed. A-B Measurements in mm. Mean.	Observed. A-B Measurements in mm. Maximum.	Observed. Common Difference.	Calculated.* Mean.	Calculated.* Common Difference.
1	·161	·163	·167		..	
2	·21	·23	·28	·067	·23	..
3	·35	·38	·40	·15	·383	·153
4	·47	·53	·55	·15	·537	·153
5	·63	·68	·70	·15	·690	·153
6	·79	·84	·86	·16	·843	·153
7	·96	·99	1·03	·15	·997	·153
8	1·12	1·15	1·26	·16	1·15	·153

* ·23 has been taken as the first term and 1·15 as the last.

Table VIB. indicates that the (A-B) measurements of the last seven larval instars of a single larva are also approximately in regular arithmetical progression; for this table the same examples of larval records as given in Table VIA. are used, together with some from Tables IV. and V. The first larval instar is well separated from all other instars, both on the shape of its ninth abdominal segment and on the isolation of its (A-B) measurement when those of all instars are placed in a regular series.

Other Species of Elateridæ.

By the method of grouping the (A-B) measurements of a random larval population, and then using the information as a guide in rearing

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DESCRIPTION OF PLATE 2.

Lacon assus Cand.

A.* First larval instar; dorsal view of ninth abdominal segment × 60.
B. Full-grown larva; dorsal view of ninth abdominal segment × 12.

Lacon variabilis Cand.

C.* First larval instar; dorsal view of ninth abdominal segment × 60.
D.* Second larval instar; dorsal view of ninth abdominal segment × 60.
E. Full-grown larva; dorsal view of ninth abdominal segment × 15.

* Drawn from permanent mounts.

PLATE 2.

work, it was found that with *Heteroderes carinatus* Blbn. ([a]), *Heteroderes cairnsensis* Blbn., five other *Heteroderes* species, *Lacon humilis* Er., *Lacon lateralis* Schw., and seven other *Lacon* species, each group represents an instar. Further, the means of the groups (with the exception of those representing the first larval instars) for each species advance approximately in arithmetical progression. As with *L. variabilis,* so with all the above-mentioned species, the specific shapes of the ninth abdominal segments are not assumed until the second larval instars. The ninth abdominal segments of *L. lateralis, H. carinatus,* and *H. cairnsensis* are illustrated in Plate 3 (figs. A to F), while *L. assus* Cand. is similarly treated in Plate 2 (figs. A and B). This species has been reared from the egg up to the third larval instar and over the last two larval instars, and there is every indication that the larval growth of *L. assus,* as expressed by the increase of the (A-B) measurements of successive instars, is similar to that of the other *Lacon* species with which more complete rearing work has been carried out.

Hyslop (2) in his drawings of the first and last larval instars of *Monocrepidius lividus* illustrates and draws attention to a difference in shape of the ninth abdominal segments which is similar to that found in many of the species mentioned in this article.

Some observations have been made on two species of larvæ (of the yellowish semi-flattened type) the adults of which have not been even generically identified. One here termed B sp.[a] and the other Y sp. (commonly found when chipping in some of the hillside country around Mackay) behave, in so far as growth of the last five larval instars are concerned, in a manner similar to the *Lacon* species, and *Heteroderes* species. The smaller instars of B sp. and Y sp. have not been studied.

No species with the cylindrical type of larva have been studied in detail. The (A-B) measurements of twenty-four cylindrical larvæ of the same species taken from rotted wood could be placed into four distinct groups; the means of these groups approximated very closely to an arithmetic progression. Exuvial measurements taken as the larvæ were reared to adults (four obtained) indicate that each group represents an instar.

Times of feeding of all the *Lacon* species, all the *Heteroderes* species and B sp. are similar to that of *L. variabilis* as described on page 56.

C. LARVAL STADIA.

Lacon variabilis.

As climatic conditions play a great part, both in the variation of the larval stadia of *L. variabilis* and in the incidence of this pest in

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(*a*) The writer is indebted to the British Museum for the identification of *H. carinatus, H. cairnsensis, L. variabilis, L. assus, L. lateralis,* and *L. humilis. H. carinatus* is listed as *Monocrepidius* in Master's Catalogue (1886) (according to a communication from H. Hacker, Queensland Museum), and specimens of *H. cairnsensis* are labelled *Monocrepidius cairnsensis* in the Bureau collection at Meringa. In *Coleoptera of North America* (1883) Leconte and Horn state: "The genus *Heteroderes,* adopted by Candeze, appears to be untenable and heterogeneous; our species are therefore referred to *Monocrepidius.*"

a The British Museum authorities identify this species as Gen. (?) (near Athous).

different years (10), fig. 1 has been inserted for the purpose of giving some idea of the climatic conditions prevailing in the Mackay district. Although there are large variations in rainfall in different years, the usual climatic sequence is a wet season of varying intensity between December and March, moderate winter rains, and a comparatively dry spring followed by thunderstorms in early November.

Many field observations made during 1932-33 indicated that, in general, the behaviour of the larvæ of *L. variabilis* in the rearing jars in the laboratory during those years, very closely resembled that of the larvæ under natural field conditions. For the purpose of discussing the stadia of larvæ under natural conditions, the larvæ may be divided into three classes according to the period of the year during which pupation takes place, together with the period of oviposition of the eggs, from which the larvæ emerge. These three classes are—(*a*) Those which emerge from eggs deposited durnig the period November-February and which pupate in the following October to January; (*b*) Those which emerge from eggs deposited in November-January and which pupate in the following March to April; (*c*) Those which emerge from eggs laid by adults from "*b*" class larvæ and which pupate in the following November to January.

Tables IX. and X. present a record of the larval stadia of forty-eight "*a*" class larvæ reared during 1933. It is considered that these tables illustrate the normal growth rate of the larvæ under the usual climatic conditions of the Mackay district (see fig. 1). The true average length

TABLE IX.—STADIA OF LARVAL INSTARS DETERMINED FROM THE RECORDED OBSERVATIONS ON 53 LARVÆ, 48 BEING "a" CLASS AND 5 "b" CLASS.

Laboratory Number of Larva.	Stadia (in Days) of the Larval Instars.								Complete Larval Period.
	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	8th.	
4	7	14	24	30	32	53	20	164	344
5	8	12	28	9	25	51	50	155	338
12	12	20	34	15	31	34	39	148	333
26	6	7	8	13	22	12	44	37	149
30	9	10	17	14	26	28	43	168	315
33	11	20	22	16	24	20	38	180	331
35	7	7	15	36	25	20	69	158	337
37	13	21	11	17	30	39	39	127	297
39	14	11	17	30	39	39	25	123	298
41	7	37	20	30	34	21	42	142	333
62	12	20	11	13	16	35	31	169	307

TABLE X.—LARVAL STADIA DETERMINED FROM THE RECORDED OBSERVATIONS ON 48 "*a*" CLASS LARVÆ REARED FROM EGGS TO ADULTS DURING 1933.

Larval Instar.	Stadia (in Days).			
	Minimum.	Mean.	Maximum.	Standard Deviation.
1st	5	9·5	14	2·73
2nd	7	14·9	37	6·16
3rd	11	18·9	34	4·82
4th	13	20·2	31	8·48
5th	16	28·2	39	7·16
6th	20	32·8	53	9·78
7th	20	38·2	69	12·11
8th	119	152·0	180	16·67

of the larval period of these forty-eight specimens was 314·8 days. During 1933 a total of 102 "*a*" class larvæ reared from eggs to pupæ spent an average of 302·2 days in the larval state. The forty-eight larvæ of Table X. are included in this number, some of which hatched from eggs deposited fairly late during the November-February period. During 1932, 128 "*a*" class larvæ spent a true average of 279·4 days in the larval state but, as Tables IV. and VIA. indicate, in 1932 a greater proportion of the observed larvæ were hatched from eggs deposited in January or early February than was the case in 1933, when many of the eggs used for rearing purposes were obtained in November and December.

In 1932, six out of 134 larvæ reared from eggs oviposited during November-January pupated during the following March and April, while in 1933, five out of 107 behaved similarly. During the two years, the minimum larval periods of these "*b*" class larvæ were fifty-seven days for those passing through six larval stadia only before pupation, and sixty-eight days for those with eight larval instars. Another "six larval instar" specimen required 161 days to complete its larval life. When the stadia of these "*b*" class larvæ are compared with those of

DESCRIPTION OF PLATE 3.

Lacon lateralis Schwarz.

A. Full-rown larva; dorsal view of ninth abdominal segment × 15.
B.* First larval instar; dorsal view of ninth abdominal segment × 60.

Heteroderes carinatus Blbn.

C. Full-grown larva; dorsal view of ninth abdominal segment × 15.
D.* First larval instar; dorso-lateral view of ninth abdominal segment × 60.

Heteroderes cairnsensis Blbn.

E. Full-grown larva; dorsal view of ninth abdominal segment × 15.
F.* First larval instar; dorso-lateral view of ninth abdominal segment × 60.

* Drawn from permanent mounts.

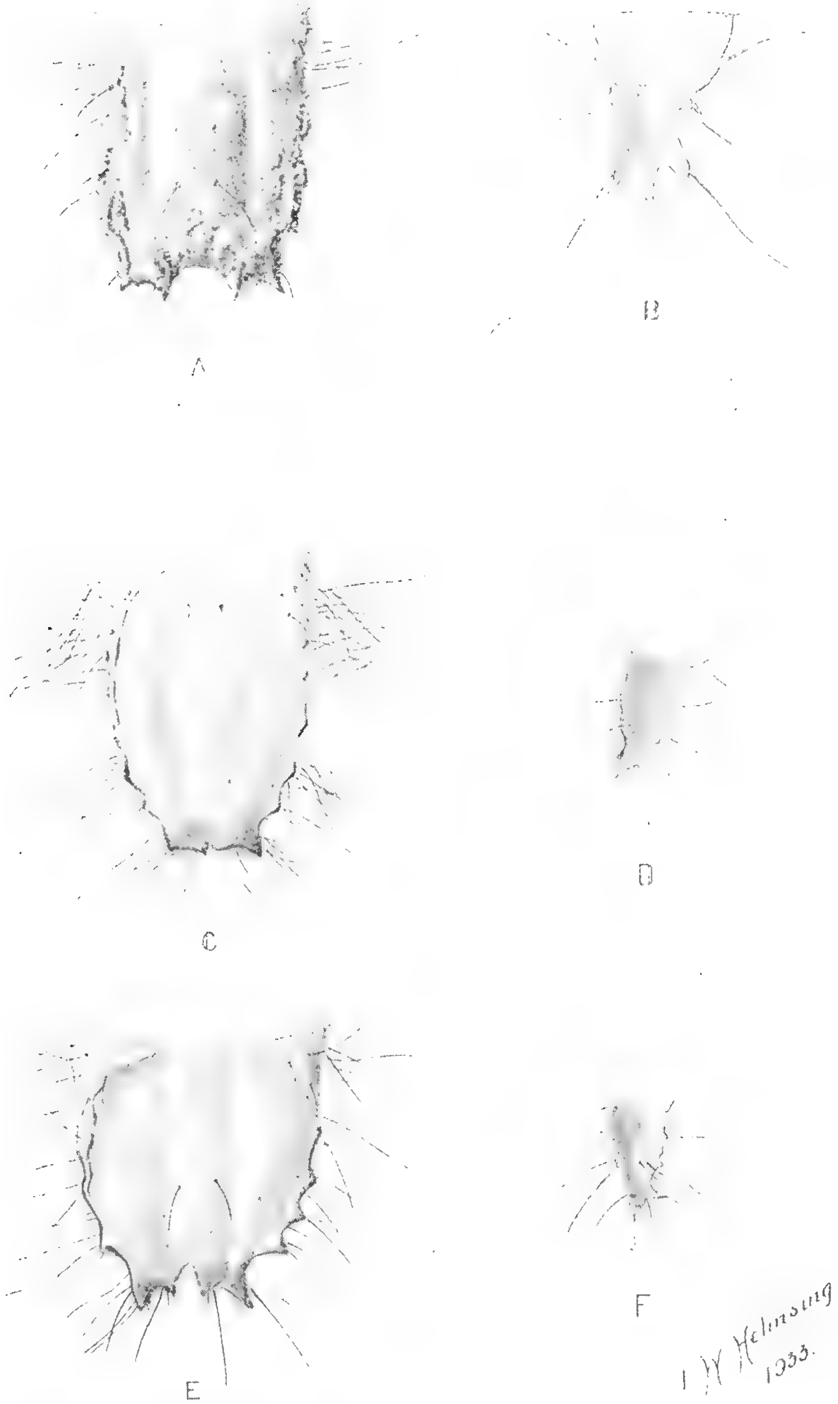

PLATE 3.

"a" class, as in Tables IX. and X., a shortening of some of the stadia is evident. Of course the last two stadia exhibit the greatest actual reductions, but not always the greatest proportional reductions.

The "c" class larvæ are considered to be even more rare in the field than are the "b" class larvæ. This is to be expected (see Section D and fig. 1) as the normal climatic conditions militate against the survival of the smaller instars. In the laboratory many of the adults from

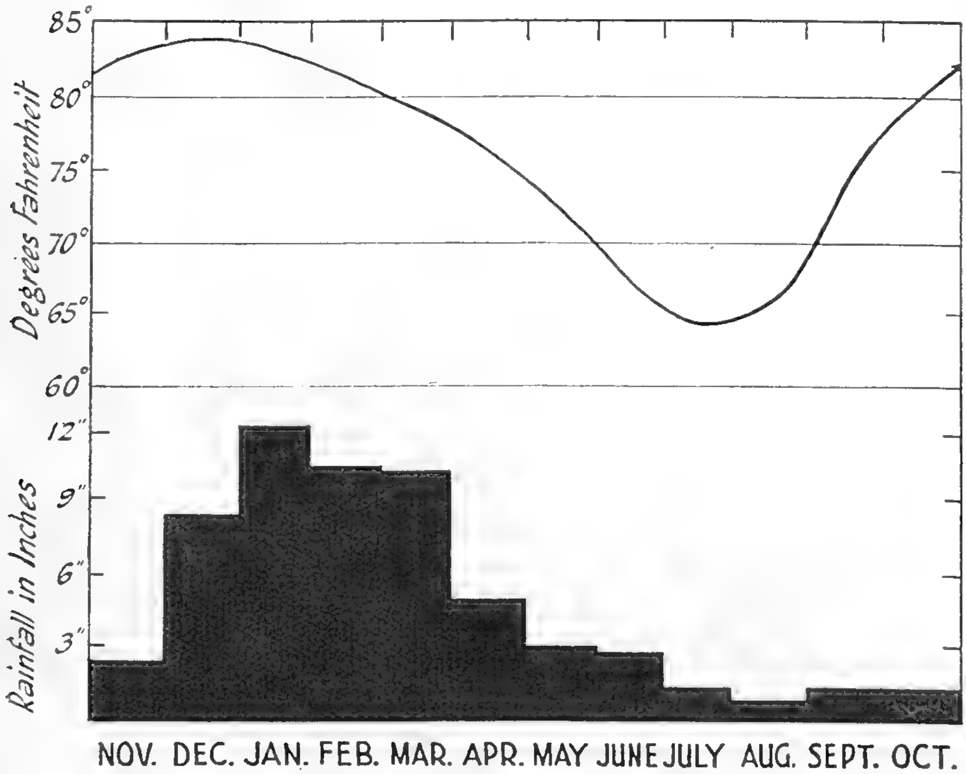

PLATE 4.

Mean monthly rainfall, in inches, and mean 9 a.m. shade temperatures at the Mackay Sugar Experiment Station for the twenty years 1910-1930, both inclusive, but with 1918—an abnormal cyclone year—excluded.

"b" class larvæ do not oviposit except under such an artificial condition as increased temperature. It is an easy matter to take the larvæ which emerge from eggs so obtained over the first four or five larval instars, provided the temperature is kept up and suitable soil moisture is provided; under normal environmental conditions the mortality percentage is very high, although once a larva reaches its fourth or fifth larval stadium it will survive under normal conditions. Comparing the stadia of "c" class larvæ with those represented in Tables IX. and X. it will be found that generally speaking the earlier stadia are considerably lengthened at the expense of a very noticeable shortening of the later ones.

It is impossible to state definitely whether a small larva found in the field in August or September is in the "a" or "c" classes as it may be an "a" class larva from an egg deposited in late January or February,

which during its early larval life experienced unfavourable environmental conditions. As "*c*" class larvæ are considered to be so rare, it is usual to place any small larvæ found in the field during August and September into the "*a*" class, but this classification may be proven to be incorrect if the larvæ are reared to pupation. As in the "*b*" class so some "*c*" class larvæ pupate at the end of the sixth larval instar, but this has never been found to occur when dealing with any larvæ known to belong to the "*a*" class. If "*a*" class larvæ are kept over the winter in soil with suitable moisture and at the mean shade temperature for October (79·7 deg. F., see fig. 1) they pupate as early as June and never later than August; there are always eight larval stadia.

On the 27th July, 1933, thirty larvæ in their eighth instars were taken from the field. Fifteen were placed in a chamber kept at approximately the mean shade temperature for October, and all had pupated by the 20th August. The second fifteen were reared under normal conditions (i.e., similar to the conditions experienced by the other fifteen except for the increased temperature), and these pupated in late October and November.

Adults of *L. variabilis* have, collectively and sometimes singly, a rather lengthy laying period—collectively from October to February for the majority, and from March to April, for a very few. The vast majority of adults appear in November and early December; the pupal stage is approximately fourteen days and the adults do not remain long in the pupal cells. The first oviposition usually takes place at about three to four weeks after the emergence of the female adult. Irrespective of the exact time of oviposition within the November-February period, and the environmental conditions subsequently encountered by the larvæ, pupation takes place either in the following May-April or October-January. There is no "hang-over," and even all "*c*" class larvæ pupate not later than the January following the May-April during which they had emerged from eggs.

In addition to environmental conditions, some physiological difference in their make-up may be responsible for the fact that some larvæ pupate at the end of their sixth larval stadia and some pupate before the winter, after passing through eight larval stadia.

Other Species of Wireworms.

Under Mackay conditions the following species normally have egg, pupal, and larval periods of very similar length to those of *L. variabilis,* viz.—*Heteroderes carinatus, H. cairnsensis,* five other *Heteroderes* species, *Lacon humilis, L. lateralis,* seven other *Lacon* species and B. sp. These species also pass through larval stadia in a manner similar to *L. variabilis,* i.e., the earlier stadia are short compared to the last one or two, especially the final one. Many specimens of all these species are to be found in the fields or in grass lands in either of their last two larval stadia by July-August, although they do not pupate until September-February. The majority of adults of *L. variabilis* are to be found in suitable places in the field in November and early December. However, this is not so for some of the other species; B sp. is found in the adult stage in largest numbers as early as the middle of October. Adults of *H. cairnsensis* are often found in large numbers with any early appearing *L. variabilis* adults. Adults of *H. carinatus,* the other *Heteroderes* species, *L. humilis, L. lateralis,* and other *Lacon* species are

to be found in greatest numbers during the wet season (January and/or February). *L. lateralis* is usually the species of Elaterid adult most common during the latter end of the wet season; *L. assus* also appears in greatest numbers during the wet season. The earlier larval stadia of this species are also short as compared to the final one. Specimens of two of the unidentified *Lacon* species have pupated leaving exuviæ with (A-B) measurements corresponding to those of larvæ which have not reached their second last larval instars.

D. TECHNIQUE.

Obtaining and Hatching the Eggs.

From most species eggs were obtained by placing female adults in glass jars (see below) which were two-thirds filled with soil of moisture of about one-half that of the "sticky point" [a]. Potato tuber was sometimes supplied as *Lacon variabilis* adults and those of some of the other species gnaw it. Eggs were hatched either in the soil in the jars in which the females had been confined, or singly in soil in the receptacles to be used for rearing the larvæ during the smaller instars.

In the matter of distinguishing the female adults from males, size is often of considerable help; for all species with which the writer dealt the smaller specimens were invariably males and the larger ones were females. Adults of *L. variabilis* were examined in more detail than those of other species, and in this species the very small adults are males, the large ones are females, and those of medium size may be either male or female. External sex differences are more definite in the pupal than in any other stage; they are manifest on the venters of the

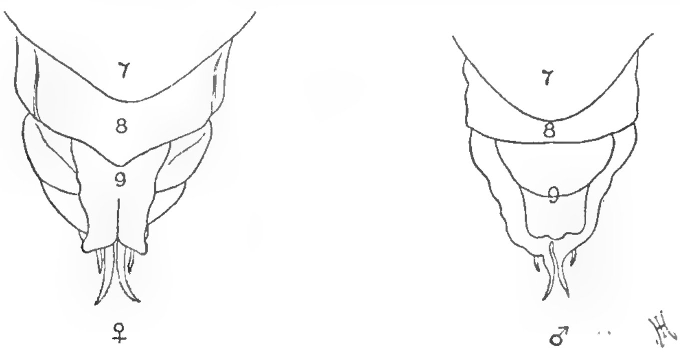

PLATE 5.

Ventral views of eighth and ninth abdominal segments of *Lacon variabilis* pupæ: ♀ and ♂ × 15.

ninth abdominal segments. The sex difference in *L. variabilis* pupæ as illustrated in fig. 2 is similar to that for all *Heteroderes* species and *Lacon* species examined by the writer.

(*a*) E. S. West defines the "sticky point" as the moisture content of the soil expressed as per cent. oven-dried soil, when the kneaded soil mass just fails to adhere to external objects. (Observations on Soil Moisture and Water Tables in an irrigated soil at Griffith, New South Wales, 1933.)

When any of the soils used in all of the wireworm work was considered to be in a state of good tilth, it was found that the moisture content was at about one-half the "sticky point."

Rearing the Larvæ.

Four-ounce glass jars with metal screw caps were used as cages in general rearing work with most of the species, but for some of the species with larger larvæ (e.g., *Agrypnus mastersi* Macl.) larger jars of the same type were found to be necessary. Each larva was kept separately in a jar two-thirds filled with soil on which was placed, cut surface downwards, a piece of potato tuber; for larvæ known to be carnivorous, scarabæid larvæ were supplied instead of potato tuber. When dealing with the larger larval instars of all species, the soil moisture in the rearing jars was kept at a little under one-half the "sticky point" for the soil used. The older larval instars of all species can withstand considerable drying out of the soil.

Some writers (8 and 11) have pointed out that it is a relatively easy matter for the older wireworms of the species studied by them to adjust themselves to most unfavourable conditions and still survive, but the smaller instars are very susceptible to changes in environmental conditions. Lane (8) used this fact in formulating a control for *Ludius pruininus* Horn, var. *noxius* Hyslop.

The writer found it impossible to rear the wireworms, with which he was concerned, from eggs to adults without a knowledge of the environmental conditions desired by the younger instars of the different species. Younger instars of the different species might need very different conditions for their survival and normal development. For example, take the case of *L. variabilis* and *H. carinatus*. The larvæ of the former species, if they are to survive and develop normally, must have excessive soil moisture during the lives of the small instars. On the other hand, at the same room temperature, and under similar conditions, the small instars of *H. carinatus* cannot live; a moderately moist soil environment is needed in this instance. Ordinary drain pipes, sunk into the ground to a depth of 2 feet 6 inches and with brass gauze fixed to the lower ends, were at times also used as cages. These were filled with soil up to the level of the ground surrounding the pipes and, as far as practicable, the soil conditions inside the pipes were made similar to those of the surrounding soil. These pipes were placed in well-drained land and as a result it was found that they could not be used for rearing *L. variabilis* from eggs to adults under natural weather conditions, whereas they were, under similar conditions, quite suitable for this purpose so far as *H. carinatus* was concerned.[a] Larvæ of these two species are the wireworms most commonly found in cultivated cane fields in the Central Queensland mill areas.

During 1932, by dint of keeping the soil in the rearing jars at approximately its "sticky point" during the lives of the younger instars, the rearing of *L. variabilis* from eggs to adults was found to be a comparatively easy matter. Also, by providing the necessary conditions for the younger instars of most of the species of the genera *Heteroderes* and *Lacon*, and B sp., fairly satisfactory data concerning their larval lives were obtained. During this year (1932), however, very

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[a] A preventive control (9) of *L. variabilis* has been developed, and has proved very satisfactory where topographical and economic conditions are such that the necessary drainage can be done efficiently. This control is based on field observations and the fact that, more so than any other species of wireworm inhabiting cultivated cane fields in the Central Queensland sugar areas, the young instars of *L. variabilis* needs excessive soil moisture for their survival.

few of the smaller exuviæ were recovered from the soil in the rearing jars. Attempts to rear the young wireworms between pieces of damp filter paper, or in small pellets of soil between pieces of damp filter paper, were not successful; under these conditions no larvæ survived. During December, 1932, and during 1933, very small instars were successfully reared by using small salve tins (1 inch in diameter by $\frac{5}{8}$ inch deep) as cages. By the help of the facts reported in Section B. (pp. 44-60) and inspections every second day, it was possible to recover most of the small exuviæ from the soil in these "salve tin" cages (for *L. variabilis* see Table VIA.). When larvæ were in the fourth or fifth stadium they were removed from these small cages to the 4-oz. jars.

Pupæ were seldom affected if removed from their pupal cells. When a pupa was found it was placed in a depression in the surface of the soil (after it had been pressed down) in its rearing jar. The final larval exuvium was very often found attached to the posterior end of a pupa from a larva of the semi-flattened yellowish type. Attachment is usually made by strings (mostly intima of the tracheæ) which have become entangled with the barbed spines at the extremity of the pupal abdomen.

As mentioned in Section B, four adults were obtained from twenty-four larvæ taken from rotted woods. Whilst collecting these larvæ it was observed that some were feeding on the internals of larvæ of the tenebrionid *Uloma westwoodi* Pasc.; when in captivity for six months their environment consisted of broken-up rotted wood, kept damp. As food they were provided with any wood-inhabiting tenebrionid larvæ available.

Measuring the Greatest Width of the Ventral Mouth Parts.

For this purpose use was made of a micrometer eye-piece and objectives of three different powers. Calibration was such that with objective (*a*) 4·25 divisions on the eye-piece scale equalled 0·2 mm., with objective (*b*) 3·0 divisions equalled 0·7 mm., and with (*c*) the measurements were in millimetres direct. When working with *L. variabilis* objective (*b*) was used for all instars, while for specimens of first instars set in slides, objective (*a*) was also used.

Whilst being measured the living larvæ were held on the microscope stage between two glass slides (for the larger instars) or between a glass slide and a cover glass (for the very small instars).

Summary.

1. The reliability of larval length, antennal segment ratios, head width, and the greatest width of the ventral mouth parts ((A-B) measurements), as criteria for determining larval instars of *Lacon variabilis* are discussed. Evidence collected during the rearing of this species from eggs to pupæ demonstrates that any of its larval instars can be recognised by the greatest width of its ventral mouth parts. The application of Dyar's Law to this species is discussed. The (A-B) measurements of a random larval population can be divided into well-defined groups of which each represents an instar. When the means of the groups representing the last seven larval instars are arranged in order of magnitude, it will be seen that they advance in arithmetical progression. The (A-B) measurements of the last seven larval instars of a single larva are also approximately in arithmetical progression.

There are normally eight larval instars in the life of *L. variabilis*, but a small percentage of the larvæ of this species pupates at the end of six larval stadia. The first larval instar is distinguished from all other instars, both by the shape of its ninth abdominal segment and the isolation of its (A-B) measurement when such measurements of all instars are placed in a regular series.

2. By the procedure of grouping the (A-B) measurements of a random larval population, calculating the means of the groups, and using the information as a guide during rearing work, it was found that for seven species of *Heteroderes* and for nine other *Lacon* species, each group represents an instar. Further, the means of the groups (with the exception of those representing the first larval instars) for each species advance approximately in arithmetical progression. As in *L. variabilis* so in all these species the first larval instars are easily distinguished from any other instars.

3. The distinctive appearance of any instar prior to ecdysis and the feeding habits of the larvæ under certain conditions were of practical help in placing to within a few days the dates of some of the ecdyses of the smaller and moderately-sized larvæ.

4. The larval stadia for *L. variabilis* are given; under Mackay conditions larval growth is usually more rapid during the earlier stadia. The larval growth rates of several other species of *Lacon* and several species of *Heteroderes* are similar to that of *L. variabilis.*

5. Technique used by the writer in rearing some wireworms is described. In this connection it should be noted that the critical point in the larval period of all the species with which the writer had to deal is the early instars. In the rearing of the larvæ from first larval instars to final larval instars, success was dependent upon providing the small instars with suitable environmental conditions. The early instars of different species may require, for their survival, quite different environments.

Thanks are due to Mr. Robert Veitch, Chief Entomologist of the Department of Agriculture, for his courtesy in making available the services of Mr. I. W. Helmsing, to whom credit for the preparation of the excellent illustrations is due.

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PLATE 6.

Large white baconers raised under grazing conditions on Mr. C. B. Peter Bell's Maroon Homestead Farm.

Buffalo Fly Control in North-West Queensland.

IN this article it is proposed to outline the methods adopted in North-West Queensland in an endeavour to check the eastward movement of the buffalo fly. But before considering control measures it is proposed to briefly discuss other features which will prove of interest to readers.

For the purpose of this article it is proposed to discuss the subject under the following headings:—

1. The History of Buffalo Fly introduction to Australia.
2. A summary of the life history and the habits of the fly.
3. Methods of control and a description of the machinery in operation in North-West Queensland.

Historical.

The buffalo fly (*Lyperosia exigua*) is a biting blood-sucking fly closely related to, but distinct from, the horn fly (*Lyperosia irritans*) which has caused such devastation in North America and the Hawaiian Islands.

It is thought that it first entered Australia from Melville Island, reaching the mainland with the first introduction of buffaloes in 1825. Three years later, in 1828, buffaloes were shipped to the mainland of Australia, and it is thought that from that time the fly first made its appearance in the Northern Territory in the vicinity of Darwin. With the gradual growth of the pastoral industry the fly has grown into prominence, and in 1912 Dr. Gilruth, the then Administrator of the Northern Territory and a Veterinarian, officially announced that the fly was existent there and might assume serious proportions. Since then many scientific observers have referred to the fly in reports following experience in the Northern Territory.

For some unknown reason the buffalo fly for a considerable time remained localised in the vicinity of Darwin, but of recent years, possibly on account of the fly having more fully adapted itself to changing conditions and environment, it has spread alarmingly, and the northern pastoral country of Western Australia, the Northern Territory, and parts of Queensland are threatened with invasion. Already, North-West Queensland is feeling the effects of the buffalo fly invasion, and not that alone but also the inconvenience which necessarily must follow in its wake, the observance of regulations enacted to control the movements of cattle.

Strange as it may seem Queensland was the last State to be invaded, and this is possibly explained by the fact that little movement of cattle took place into Queensland from the Northern Territory along the coastal stock routes where conditions of temperature and moisture are favourable to the propagation and spread of the buffalo fly. Most, in fact all, movements of stock took place over the Tableland country of the Northern Territory, entrance being made to Queensland at the Lake Nash crossing gate, some distance south of Camooweal.

PLATE 7.
General view of spraying plant at Kajabbi.

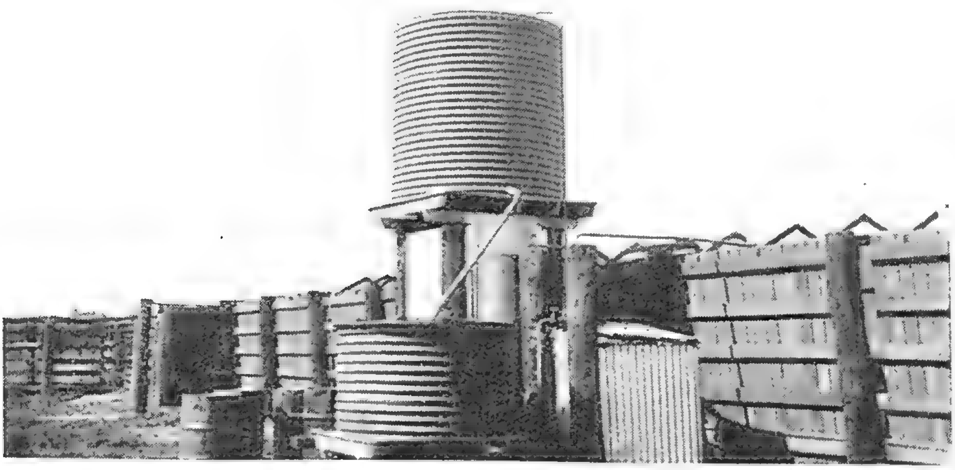

PLATE 8.
Side view of plant at Kajabbi, showing the boarded race, top reservoir tank, lower mixing tank, and right centrifugal pump. The engine is housed beneath the tank stand.

In crossing this long stretch of high open country, which experiences particularly cold snaps during the season in which cattle travel, it has been found that the buffalo fly tends to desert travelling stock. This is so since the optimum conditions of temperature and moisture are non-existent. Perhaps another factor has assisted to shield North-West Queensland from invasion earlier, and that is the roughness of the country on the Northern Territory border near the Northern Coast, which prevented natural movement of cattle in an easterly direction.

However, whether it was non-adaptation to Queensland conditions or natural barriers which temporarily arrested the buffalo fly, we are now faced with the fact that the whole of the cattle and dairying country of Northern Queensland is in jeopardy, and only the constant vigil of those in authority, assisted by the pastoralists themselves, can hope to check its fast movement eastward.

The Gulf country of Queensland, and particularly the low-lying coastal belt, is favourable country for the development of buffalo fly, since optimum conditions of temperature and moisture prevail, and the northern coast is thus considered the possible portal through which the rich and wealthy east coast is threatened.

Life History and Habits of the Fly.

In the Netherlands Indies the buffalo fly feeds on the blood of cattle, including zebus, and other races of native cattle, and also buffaloes, but not as far as is known on any other animals.

In Northern Australia, however, the fly attacks buffaloes, cattle of all kinds, horses, mules, donkeys, and in cases of gross infestation it may elect to attack man. Respecting cattle, it has been noted that it prefers bulls to bullocks, or cows, and perhaps dark-coloured beasts are more frequently selected by the fly, but it is certain that fine-haired smooth-coated animals are more frequently the subjects of attack than the long-haired and coarse type. In gross infestation, however, neither of these factors is of importance.

The female lays her eggs in bovine manure, the eggs being deposited in the cracks and crevices of fresh fæces. Here the stages of the life cycle are gone through, the egg developing into the larva, the larva to the pupa or cocoon, and finally the adult or imago stage is reached. Murnane, who made investigations for the Commonwealth Government on the buffalo fly question in North Australia, has stated that the entire life history may be completed in nine days. Hence, under suitable conditions, it is seen that commencing with a small infestation, a gross infestation could soon be experienced.

The adult fly is a slender insect, metallic grey in colour, and about half the size of the common house fly. This is contrary to the opinion that I have heard voiced by many people who suppose the insect to be of large proportions, possibly because of the name. But the name is only indicative of its original host, the buffalo, and has no bearing on its size whatsoever. It can be easily distinguished from the small bush fly so commonly found in the Gulf country. The small bush fly is black in colour, whereas the buffalo fly is much lighter in colour. When feeding on cattle the glistening wings are held projecting upwards at an angle from the body. When disturbed it rises quickly, but just as rapidly returns to assume its characteristic poise of outstretched wings.

PLATE 9.
The spraying race from the entrance.

PLATE 10.
The loading race at Railway Siding.

Under natural conditions it favours certain parts of the body behind the poll and the base of the horns, the withers, the lumbar region, and low down in the sheltered portions of the flanks and ribs. Undoubtedly these protected parts are favoured since they are inaccessible to the continuous switch of the tail.

Upon careful examination the most striking feature of the fly is its proboscis, which forms a rigid tube-like prominence somewhat swollen at the base, and this is forced through the skin of the host like a needle. A pair of finger-like palps lie along the side of the proboscis. Frequent and heavy rains reduce the number of *Lyperosia* in the field by washing out the dung pads and making them unsuitable for the larvæ. Long dry periods desiccate the pads so quickly as to render them unfit for the developing larvæ. Under either of these conditions, the incidence of the fly decreases.

Seasonal Incidence.

The buffalo fly has a seasonal incidence, its numbers increasing enormously with the advent of the rainy season, which in North-West Queensland usually extends over the months December to March or April. By the end of the wet season and for a short time afterwards the fly is present in gross numbers. The conditions existing in July and August are not so favourable to its propagation, so it is found that in these months when the cold weather appears the fly infestation is at its lowest. With the rising temperatures onwards, until December, it will remain at the point of lowest infestation, but again with the onset of the wet conditions the incidence reaches its maximum.

Effects of Infestation.

When suddenly exposed to gross infestation, cattle have been observed to exhibit intense "fly" worry, evinced by restlessness, constant switching of the tail, and tossing of the head. On the other hand, cattle reared in infested country appear to gather a tolerance to the attack of the flies, although upon heavy infestation the worry is noticeable.

However, the fly exacts its toll in the quantity of blood that is drawn during feeding. When flies are present in countless thousands as they sometimes are, the loss of blood must be quite considerable, and the consequent loss of condition great. What condition is lost by this means it is not possible to estimate. Furthermore, the constant irritation and the endeavours of the animal to allay the irritation by rubbing against trees and other objects often leads to the formation of raw granulating wounds about the jowl and dewlap, and as in the case in many Hereford cattle, at the medial canthus or the inner corner of the eye.

There is one redeeming feature of the buffalo fly infestation and that is its seasonal incidence. It has been stressed that the fly is present in greatest numbers during and for a short time after the rainy season. At that time the grass is green and luxuriant, and with plenty of feed the strain on the growing animal is not so heavy. With the dry season, May to December, the infestation is at its lowest ebb, and it is fortunately at the time when the beef animal in the north is hard pressed to exist.

Methods of Control.

In the light of the experience gained by scientists the world over, it has been realised that the control of pests of all descriptions offers

PLATE 11.

Bullocks in the spraying race with plant working. Note the sprays above and below the animals on both sides.

PLATE 12.

The Leichhardt River, at Kajabbi, from the railway bridge, North Queensland.

numerous obstacles. This has been found to be the case in instances where a less active subject than a fly has entered into the picture, hence, remembering that the buffalo fly is a winged parasite, proved to be capable of flying a distance of 30 miles, the right thinking man can readily understand the difficulties which present themselves in devising methods of control.

Not only in Queensland has the difficulty been appreciated. Western Australia too has met similar obstacles, but in Queensland the difficulties are far worse.

In Western Australia it was early realised that a great risk was encountered in bringing cattle from the buffalo fly infested areas of the West and East Kimberleys to the south-west corner of the State, where the State's finest dairy farms are centred. Hence, a scheme was devised whereby cattle before shipment at the port of Derby were subjected to treatment with a substance which experiment proved to be lethal to the life of the fly, i.e., when coming in contact with the fly, it killed. This has proved successful insofar that the fly has not reached Fremantle, where cattle are unloaded since the institution of spraying facilities at Derby. But it must be remembered that the time taken for steamers to reach Freemantle from Derby is some ten days, and furthermore, owing to the presence of pleuro-pneumonia in the Kimberleys, it is compulsory to transport all cattle by sea, and during that sea voyage strong winds and cold conditions are encountered.

In Queensland, the position is a more complicated one. The only practicable exit from the buffalo fly infested areas is overland, and although similar methods of control to those employed in Western Australia have been used, it has been frought by tremendous difficulties. In short, a plant has been erected at a suitable spot, Kajabbi, which place is at the railhead at the terminus of the main stock route from infested area. Here cattle are subjected to treatment with a solution known to be lethal to the fly upon contact. Although the solution used is found to be lethal on contact, unfortunately experiments to date have failed to reveal a substance which on application has any lasting repellant action. Hence the position is that cattle, when once sprayed and placed on trucks, are subject to reinfestation with buffalo fly which choose to desert cattle still remaining in the receiving yards. Thus it is seen that the secret of handling cattle at the railhead is their expeditious trucking and their removal from the scene of operation in a thoroughly wet condition. It is thought that this difficulty has been overcome by the use of long hoses with an adjustable nozzle with which cattle on trucks are sprayed a second time, and their removal is made immediately after the second treatment.

Description of Plant at Kajabbi.

The loading of cattle at Kajabbi involves their passage through a long race leading from the drafting yards to the trucks. For the actual spraying, a specially boarded-in race is used, 108 feet in length, and provided with slide gates at its entrance and exit. The spray itself consists of three lines of 1¼-inch galvanised piping, one line placed overhead and two laterally—each running the whole length of the spraying race. These pipes are fitted with jets placed at 3-foot intervals, the lateral pipes being about 20 inches above the floor level, and the floor is concreted. The jets on the lateral pipes are set at an angle of

PLATE 13.
Rugged bank of the Leichhardt River, North Queensland.

PLATE 14.
Gregory River, near the crossing, Gulf Country, North Queensland.

45 degrees. Those on the overhead pipe are set to force the fluid in a direction straight down.

The fluid is forced through the pipes by means of a centrifugal pump driven by a petrol engine, and the jets capable of throwing a dense mist spray, which satisfactorily saturates each beast, the top sprays effecting the wetting of the backs and heads and the lateral jets the bellies and legs. Approximately $2\frac{1}{2}$ gallons of solution are used for each beast. Cattle are passed into the race to its full capacity, and the pump set in motion, and the animals retained in the race for the minimum length of time to assure complete wetting. Following this the exit door is opened and the animals set in motion, whilst the jets are still in action. When the last beast leaves the race, the pump is cut off, the exit door closed, and the race refilled for the treatment of a second crush full.

Water is conserved in a 1,000-gallon reservoir tank, and is run into a 400-gallon capacity mixing tank, which is directly connected with the spray pipes.

It has been found that the plant at its present working capacity is capable of handling cattle as fast as it is possible to truck them, animals being confined in the spraying race for only three-quarters of a minute. The daily truckings are entirely dependent upon railway facilities, and the fact that trucking must finish in time to enable inspections to take place prior to nightfall.

Results of Spraying.

After spraying it has been the practice to make a series of inspections of cattle trains en route to their destinations. Fat cattle trucked to the east coast meatworks were subjected to as many inspections as possible during transit. In all instances the first examination was made at the spray, the second 30 miles distant, and the remainder at varying distances along the line.

It is pleasing to note that at no time following the double treatment, i.e., in the crush and with hoses on trucks, was buffalo fly found to be present. In many instances dead flies were recovered from beasts after the first treatment in the crush.

Treatment of Manure on Trucks.

When it is remembered that the female buffalo fly lays her eggs in the cracks and crevices of fresh manure, it is apparent that provision had to be made for the efficient disposal of manure. Where possible, destruction was carried out by treating used trucks with superheated steam at a minimum pressure of 160 lb. to the square inch. This method was made possible by the utilisation of a railway engine fitted with steam pipes attached to the steam box.

On occasions this most efficient device could not be availed of. In such instances all trucks were treated with a concentrated borax solution.

Horses and Camels.

Although bovines are the favourite host of the buffalo fly, it was not lost sight of that horses and camels are subject to attack. Consequently, similar treatment was applied to horses and camels leaving buffalo fly infested areas. When in small numbers it was not necessary to pass

PLATE 15.
Lawn Hill Creek, Gulf Country, North Queensland.

PLATE 16.
On the Smithbourne River, Gulf Country, North Queensland.

PLATE 17.
The Byrne River Crossing, Gulf Country, North Queensland.

PLATE 18.
Vehicular ferry crossing the Norman River at Normanton.

PLATE 19.
The wharves at Normanton, Gulf of Carpentaria, North Queensland.

them through the race, and in fact the race was scarcely suitable for highly-strung horses or the long-necked camel. However, it has proved satisfactory to resort to their treatment with hoses only, in which case it has been found quite efficacious.

Conclusion.

In conclusion it must be emphasised that the matter of buffalo fly control is by no means an easy one. It must be remembered that the fly is a winged insect capable of flying considerable distances, and conditions in the Gulf country are suitable for its propagation.

The co-operation of all sections of the community concerned in those areas is essential if a legitimate attempt is to be made to hold the fly in check.

VALUE OF FODDER CONSERVATION.

Few dairy farmers in Queensland can claim that their cows are better butter-fat producers in times of drought than in seasons of plenty. Not many would be prepared to believe that it could be done, but Mr. Ben O'Connor, the veteran Australian Illawarra Shorthorn stud breeder, of Emu Creek, Colinton, has proved it more than once by following a few commonsense rules in farming.

The secret, he says, is fodder conservation. Mr. O'Connor is one of Queensland's most successful breeders of Australian Illawarra Shorthorn cattle, and this success he attributes to the strict observance of three rules: The buying of only the very best stock; liberal feeding; and the conservation of fodder, so that production might be maintained during the driest spell.

"In the first place," said Mr. O'Connor, "a cow that is not worth the best feed that can be grown is not worth keeping. Unfortunately, there are to-day too many dairy farmers in this State who have not yet realised that a low butter-fat producing cow is as expensive to maintain as a heavy yielder. There are just as many who refuse to look ahead and conserve for those inevitable droughts."

When Mr. O'Connor commenced dairying in the Brisbane Valley twenty-seven years ago he decided that the only way to succeed was to start off properly. The first task was to select a herd that would give a profitable return. This he did by travelling far and wide, visiting all the leading studs until he eventually acquired pedigreed stock of the highest quality, going so far as to pay up to ninety guineas for heifers. The result is that to-day Mr. O'Connor has a milking herd equal to any in the State. His fifty cows have returned him as much as £200 in one month.

This breeder severely culls his stock, so that quality will always be maintained. He is a firm believer in feeding his cows in stalls on lucerne chaff and maize meal, in addition to grazing them on lucerne, oats, and prairie grass.

Over 100 acres of Mr. O'Connor's property is cultivated for lucerne and maize, and any surplus growth is stacked for future use. Feeding in times of drought, under those conditions, is not much more expensive than in good seasons, and it is his experience that stock do better and give heavier yields.

Mr. O'Connor is one of the State's most successful dairy stock exhibitors. He claims the distinction of having won more champion group honours than any other breeder in the State. Between the years 1920 and 1929 his Australian Illawarra Shorthorn group was undefeated, and another outstanding performance was the winning some time ago of the champion group, open to all breeders, at the Gympie Show, for a prize of £100. This was carried off by Mr. O'Connor after his cattle had won the event three times out of four. On the fourth occasion the group was runner-up.

The noted Charm of Glenthorn was one of Mr. O'Connor's cows. This beast had over twenty championships to her credit, including the State honour at the Royal National Show, where she also secured the State butter-fat production championship, retaining the title for some time, only to be beaten by the present holder, Elsie IV. of Oakvale, who is her herd mate. This breeder's herd of fifty cows has repeatedly given a yield of 200 gallons of milk daily.—"The Queenslander."

Queensland Weeds.

By C. T. WHITE, Government Botanist.

Gomphrena Weed (*Gomphrena decumbens*).

Description.—An erect, much-branched annual herb mostly about 1 foot to 18 inches high, with a fairly stout tap root, and often rooting at the lowermost nodes. Stems in the upper or younger parts covered with numerous fine white hairs, which disappear almost entirely from the lower or older parts. Leaves somewhat elliptic (obovate-lanceolate) in outline, $\frac{3}{4}$-inch long, tapering at the base into a short leaf-stalk or petiole, smooth above, hairy beneath. Flowers white, borne in oblong or somewhat globose heads, $\frac{1}{2}$–$\frac{3}{4}$ inch long and $\frac{1}{2}$ inch across, lengthening in seed to spikes $1\frac{1}{2}$–2 inches long. Individual flowers $\frac{1}{4}$ inch long, composed of five white, semi-transparent, pointed perianth segments, surrounded at the base by a dense covering of long, white, silky hairs, each flower subtended by a bract and bracteoles, the former much broader and shorter than the latter, but sharply pointed. Seeds dark chestnut brown, smooth and rather shiny, round and flattened, 1 line in diameter.

Distribution.—A native of Mexico and Tropical America, now a naturalised weed in several tropical and subtropical countries. It is reported to have first made its appearance at Townsville about three years ago, having been noticed in a spot where some circus elephants had been feeding. It is now, however, very common along the whole coastal belt, and I have seen it as far inland as Torrens Creek.

Common Name.—I have not heard a common name applied to it.

Botanical Name.—*Gomphrena* from Gomphræna, a name used by Pliny for some plant of the same family (*Amarantaceæ*) from *grapho* I write or paint, in allusion to the highly-coloured foliage. Some plants allied to the present one are much grown in gardens on account of their coloured foliage, e.g., Alternanthera, Amarantus, Iresine, &c.; *decumbens* Latin for decumbent or reclining—in botany decumbent means reclining in the lower part, the upper part ascending or erect.

Properties.—The plant is probably quite a good fodder, though reports from different parts of the State regarding its palatability for stock are very conflicting. Stock on the whole would probably reject it or eat it only in limited quantities when plenty of other feed was available.

Eradication.—So far as I have observed the weed is not a particularly aggressive one, and does not call for any special means of eradication.

Botanical Reference.—*Gomphrena decumbens Jacq. Hort. Schœnb.* t. 482.

Acknowledgments.—I am indebted to the Director of the Royal Botanic Gardens, Kew (England), Sir A. W. Hill, for the specific determination of this plant.

PLATE 20.
GOMPHRENA WEED (*Gomphrena decumbens*).

The Peanut Industry.

A SOUTH BURNETT CO-OPERATIVE ENTERPRISE.

DOMINATING the whole town is the imposing storage and treatment plant of the Queensland Peanut Crowers' Co-operative Association—that is the first impression of a visitor to Kingaroy, a thriving centre of the South Burnett, one of the most productive provinces in Australia.

The first season in which peanuts were grown to any extent for commercial purposes in Australia was 1924, and the crop was practically all grown in Queensland, which is now regarded as the State most suitable for peanut cultivation. Very small quantities of peanuts are grown in the Northern Rivers district of New South Wales and also in Western Australia and the Northern Territory, but about 80 per cent. of the total Commonwealth crop is produced in the South Burnett district of Queensland, with Kingaroy as the centre of activities.

A marketing board was created in 1924 at the instigation of the peanut growers of Queensland. This board was formed under the Primary Producers' Organisation and Marketing Acts to have jurisdiction over all peanuts grown in Queensland for sale; and it has done much to foster, extend, and stabilise this industry. The following figures will show how the industry has increased under the control of the Queensland Peanut Board:—

Season.	Growers.	Acres.	Tonnage.	Value of Crop. £ s. d.
1924	100	691	231	10,657 10 8
1925	86	450	142	7,024 0 9
1926	250	3,000	827	38,418 4 2
1927	358	6,500	2,246	79,711 0 5
1928	557	11,500	2,886	107,930 13 8
1929	387	5,500	3,618	116,400 9 1
1930	250	2,300	727	25,773 12 6
1931	428	5,000	2,673	103,334 13 9
1932	216	2,000	551	18,788 13 10
1933	307	2,700	1,205	38,255 4 8
1934 Estimates	500	10,000	3,000	..

The production in 1928 and 1929 seasons was more than could be absorbed in the Commonwealth, and, as exporting was not profitable, this led to a restriction of areas in 1930 in an endeavour to bring the industry back to normal conditions.

In 1928 the growers took advantage of the Primary Producers' Co-operative Association Acts in order to form the Queensland Peanut Growers' Co-operative Association Limited, and at the same time growers levied themselves at the rate of ¼d. per lb. of peanuts in order to provide storage and treating machinery. The levy was first deducted by the Queensland Peanut Board from the final payment on the 1927 crop and handed by the Board to the Association.

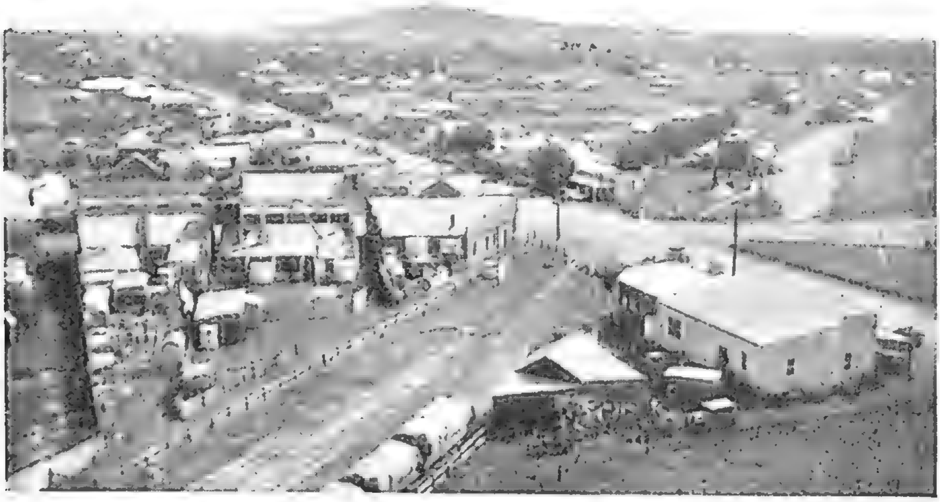

PLATE 21.

A view of Kingaroy from top of the peanut growers' silo, looking towards Mount Wooroolin, a beautiful park reserve left in its natural state.

Little more than thirty years ago the site of Kingaroy was a cattle station paddock. It is now one of the most solid farming centres in Queensland.

Bulk, storage, equipped with the most modern machinery known for the treating of peanuts for marketing, was erected at Kingaroy at a cost of £55,000, the Queensland State Government guaranteeing

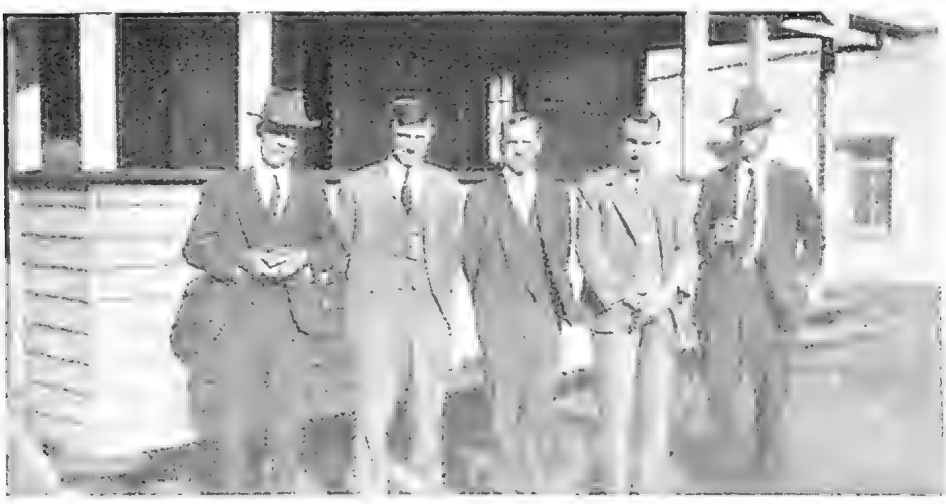

PLATE 22.

Members of the Queensland Peanut Board (left to right).—Messrs. N. J. Christiansen (chairman), C. F. Adermann, A. G. Whiting, L. Cain (Government representative), and N. A. Nielsen.

75 per cent. of the loan. The balance was raised from the 1927 levy, supplemented by the issue of preference shares in the Queensland Peanut Growers' Co-operative Association Limited. The storage capacity of the silos is 2,800 tons; while in a long shed known as the Dump, a further 1,200 tons can be stored, making a total storage capacity of 4,000 tons. The machinery consists of several cleaning

PLATE 23.

Silo, Dump, and Office of the Peanut Growers' Co-operative Association at Kingaroy. The storage capacity of Dump and Silo is 4,000 tons.

PLATE 24.—A PEANUT FIELD, SOUTH BURNETT, QUEENSLAND.

Probably no other district in Australia can surpass the record of the South Burnett in rapid settlement and development, and the relative volume of wealth production.

PLATE 25.—A PROMISING PEANUT CROP NEAR KINGAROY.

In peanut cultivation, as with other field crops, South Burnett farmers have established high standards in agriculture.

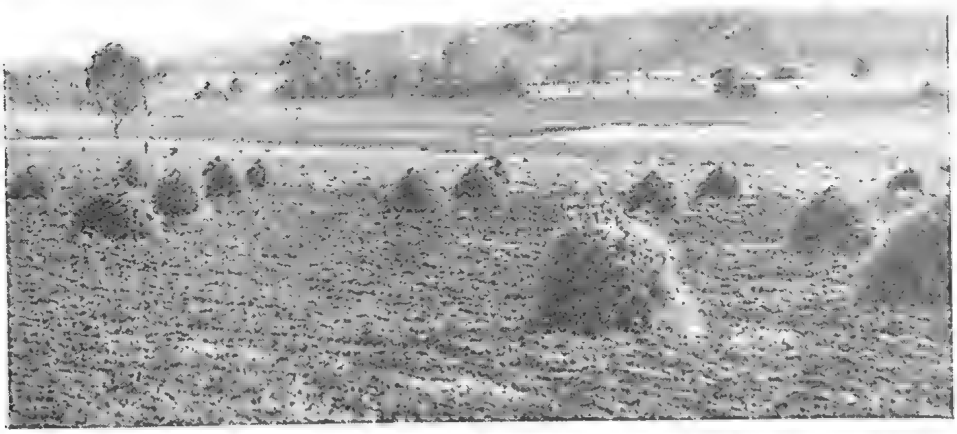

PLATE 26.—PEANUTS STOOKED READY FOR THE THRASHER, SOUTH BURNETT.

From Nanango to Goomeri and from the western slopes of the coastal range to the Bunya Mountains are belts of rich vine jungle land, alternating with stretches of fine forest country, containing extensive alluvial flats along numerous tributaries of the Burnett River. The natural agricultural richness of this region is supplemented by immense stands of hoop pine forests in the surrounding ranges.

machines which treat the nuts from the farm at the rate of 10 tons per hour or 6 bags per minute, and grading and shelling machines with an out-turn of 3 tons per hour.

Until 1930 Queensland growers had been growing the Spanish variety of peanuts almost exclusively, but the Queensland Peanut Board undertook to supply also the Virginian Bunch variety for the roasting trade. In order to assist the Board in this endeavour, the Federal

PLATE 27.
A Peanut Thrasher at work on a South Burnett Farm.

PLATE 28.—AT THE END OF THE HARVEST.
Peanuts are trucked direct from the thrasher to the silo.

PLATE 29.
Inside the silo. Top conveyor and feed to bins.

Plate 30.

Graders and Deshellers, Kingaroy Peanut Silo.

PLATE 31.—CONVEYOR BANDS, KINGAROY PEANUT SILO.

Vast bulk storage, equipped with modern machinery, for the treatment of peanuts for marketing at a cost of £55,000, *provide an excellent example of farmers' co-operative enterprise in Queensland,*

Government granted an embargo from 1929 to 1930, but, unfortunately, more peanuts were imported into the Commonwealth during the period of that embargo than during any corresponding previous period without an embargo. In 1930, the industry was granted an embargo for an indefinite time.

The 1932 crop was spoiled by dry seasonal conditions in the peanut-growing areas, with the result that there was a shortage of crop and the Board arranged with the Federal Government to permit merchants to import their requirements until the 1933 Queensland crop became available. A certain lack of confidence on the part of growers was responsible for another small crop in the 1933 season, and the Board had again to ask permission to import in order to allow the merchants to retain and supply their customers. This permission was granted

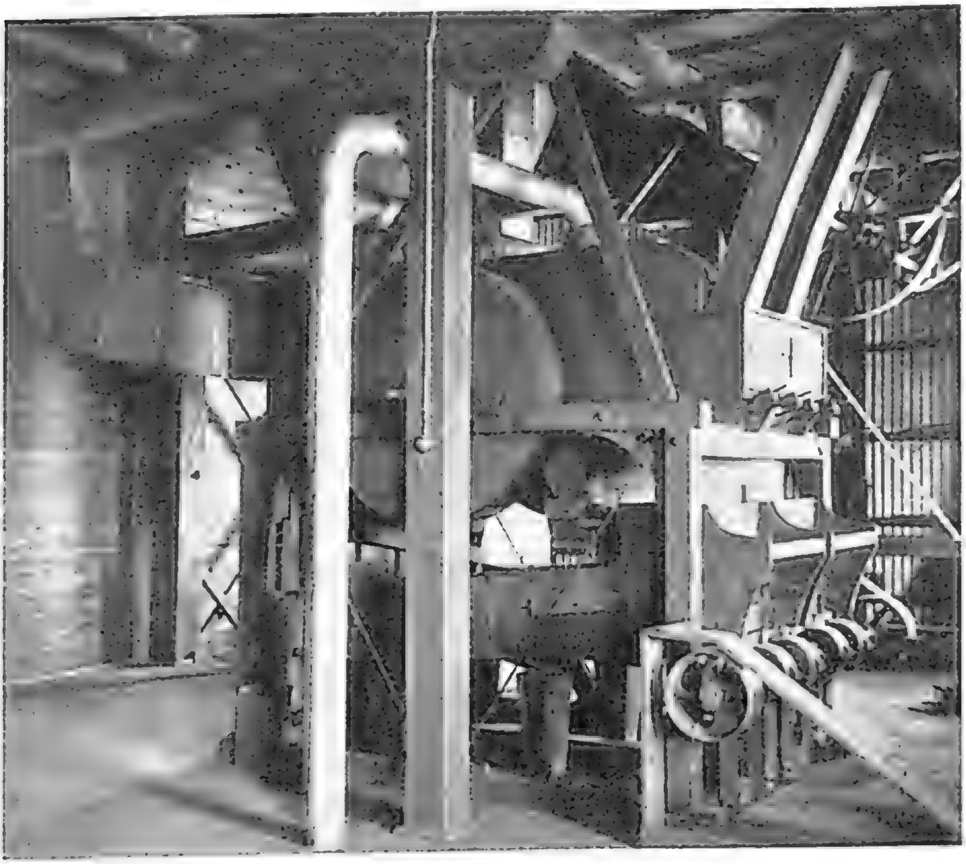

PLATE 32.
Final cleaning machine, Kingaroy Peanut Silo.

and the Board, confident of the continuance of the Federal embargo, encouraged growers to plant heavily for 1934 season. The growers, accepting the Board's advice, planted heavily, and were greatly disturbed when the embargo was lifted in December, 1933, after 10,000 acres had been planted. Since then, a very strong case was placed before the Federal Tariff Board for an increase in duty on peanuts in the shell. No decision has yet been given on this question, but peanut growers consider it necessary that an increase should be granted in

order to stabilise the industry. Queensland peanut growers have, to-date, been levied since 1927 to the extent of more than £37,000 and have honourably met all their obligations. In 1933 the Queensland Peanut Board employed 21 males and 156 females apart from the office staff, but this year, with a crop about three times that of last year, only 20 males and 90 females are employed. The lifting of the embargo

PLATE 33.—GIRL GRADERS AT WORK, KINGAROY PEANUT SILO.

In this work great skill is acquired, and the deftness of these cheerful workers is remarkable. The girls are mainly the daughters of district farmers, and represent fine types of Australian womanhood.

PLATE 34.—THE MOISTURE TESTER AND OPERATOR, KINGAROY PEANUT SILO.

may affect the grading staff principally, as these employees are engaged in the grading of the crop for the roasting trade, that is, the side of the peanut industry which is concerned mostly with overseas competition on the home market.

The wages bill of the Board and the farmers has in the past approximated £30,000 to £40,000 per annum, while manufacturers throughout the Commonwealth employ many hands and pay in accordance with the industrial awards of the different States.

Despite the depression prevailing throughout the world, the peanut industry in Australia has continued to expand and sales kept increasing until 1932, a record year from the selling point of view, and has almost completely disposed of previous surpluses.

In 1933 the Queensland Peanut Board opened a depot at Atherton to deal with the North Queensland crop, while, except in the period 1931-1932, the Central Queensland crop has always been handled in Rockhampton.

Visitors to Kingaroy are assured of a welcome at the silos which are evidence of the importance of the industry and its value as a factor in our rural economy.

SOUTH BURNETT.

Probably no province in the whole Commonwealth has a greater record of rapid settlement than the South Burnett, of which Kingaroy is one of the major centres. This rich district extends, roughly, from the Bunya Mountains and the high lands rimming the Northern Darling Downs on the south to the Kinbombi Range on the north, and from the Coastal Range on the east to the Boyne River on the west.

Thirty years ago it was mainly pastoral land, alternating with vast belts of dense vine jungle (miscalled scrub) or rain forest country. The jungle lands carried immense stands of hoop pine, and, in some parts, fair stands of red cedar. Round about Nanango and Coolabunia were the beginnings of closer farming settlement. The potential agricultural wealth of the district attracted settlers from other parts of Queensland, as well as from the Southern States. Nanango, one of the oldest towns in Queensland, then a pastoral and timber centre, to which gold mining to a small extent was also a wealth contributor, took on a new life. Kingaroy became a thriving terminus. Wondai was still a "one-horse" village. Murgon and Goomeri were merely names on the railway guide. Along the line new townships were gradually taking form.

To-day, Nanango (now a railhead), Kingaroy, Wondai, Murgon (an important railway junction), and Goomeri are populous commercial centres of the rich South Burnett, famed far and wide for the quality, volume, and value of its dairying, agricultural, pastoral, and timber production. Fine public buildings, electric light, and golf links are common to every centre. Several have aerodromes, and one, Murgon, an aviation club. Good roads radiate through their tributary territories; farms and towns are linked by telephone; and on every side are many evidences—including high schools, convent schools, and rural schools—of great cultural and material progress. In every part of the district there is an air of definite, although strenuously acquired, prosperity. It is scarcely believable that such extraordinary development—the clearing and cultivation of such vast areas—is the work of a single generation. The South Burnett was the land of the young man. Its pioneers are still comparatively young men, and in every branch of rural enterprise they have made their mark. Their dairy cattle and other live stock are represented in every important show ring. Their butter has gained the highest awards in State and Empire competitions. Their maize is equal to any grown in Australia; and they have established, and maintain, high standards in other branches of primary production for which district conditions are suitable.

The soils of the South Burnett range from the lighter loams to the deep, rich red and cocoa-coloured volcanic deposits of its jungle regions, and to the heavy black alluvia of its forest country. Added to all these advantages are a healthy climate and a wealth of scenic interest and beauty.

The Cultivation of Maize.

By C. J. McKEON, Instructor in Agriculture.

MAIZE is grown extensively in Queensland along the coastal areas and inland within the 30-inch rainfall region, the chief districts being Moreton, Wide Bay and Burnett, and Darling Downs, which among them usually produce over 80 per cent. of the State's total crop. The next district of importance is the Atherton Tableland, which, due to the comparatively safe rainfall, has much the highest yield per acre over a number of years. It will be seen from this what a vast area of Queensland is suitable for the production of this crop, and also the wide variety of soils on which it is being successfully produced.

Providing the rainfall is sufficient, and the land is naturally well drained, maize can be grown on any good quality soil, the alluvial flats found along rivers and creeks and the deep volcanic soils being particularly suitable for its growth. Good drainage is absolutely essential, for maize will not stand wet feet.

It is one of the easiest crops to grow, and, unfortunately, advantage is frequently taken of this fact, and many crops are grown under conditions which would be fatal to many other crops.

To get the best results maize requires a good soil, in which a plentiful supply of plant food is available, a condition which can only be brought about by an early and thorough preparation of the land before planting, attention to the cultivation of the crop itself, and to the eradication of young weeds during its early growth.

The land should be ploughed to a depth of at least 9 inches during the winter, and allowed to lie in the rough until the early spring. The action of the frost and rain will have a sweetening effect on the soil, and will leave it in a mellow condition. In the early spring the land should receive a second ploughing, which, if possible, should be a cross ploughing. This should not be so deep as the first ploughing, and should be immediately followed by a harrowing and cross harrowing to work the surface soil into a nice fine condition.

If a crop of weeds is turned under during the second ploughing planting should not be carried out for a few weeks at least to allow decomposition to take place. On land which is not too heavy and moist this will be greatly assisted by rolling, as the rolling will consolidate the soil and cause the decomposition to take place much more quickly. It will also at the same time make a good firm seed bed. Rolling should always be followed by a light harrowing.

Preparation of Seed Beds.

The preparation of the seed bed is one of the most important points in the production of maize, and no amount of after cultivation will undo the damage that has been caused by planting in a badly prepared piece of land.

One has only to see the difference, not only in growth but in the colour of the foliage also, between crops grown side by side, and where one has been sown on thoroughly prepared and the other on hastily prepared land, to realise how great the effect is.

Give the young crop a chance to become well established in a good seed bed—and by a good seed bed is meant not only a well-prepared one but one in which the young plants will not have to battle with a host of weeds—and, the increased return will more than compensate for the extra time and labour spent.

When to Plant.

The best time to plant naturally varies according to the different districts. In districts which have a long growing season and a comparatively regular rainfall, this can be carried out whenever weather conditions are suitable, from August to late December.

Two very important points are—firstly, to choose a variety which is suitable for the district in which it is to be grown; and secondly, to plan to have the crops tasselling at a time when there is usually a good chance of getting rain. Maize must have moist conditions during tasselling, and if hot dry winds occur during this period the pollen is destroyed and fertilization cannot take place.

Seed should be sown in drills spaced from 3 feet 6 inches to 4 feet apart, nothing less than 4 feet for the tall-growing, late-maturing varieties. As a general rule, single spacing gives the best results, the grains being dropped singly along the rows, with a distance of approximately 12 inches between the grains for the quick-maturing varieties and from 15 to 18 inches for the late-maturing varieties.

From 9 lb. to 10 lb. of seed is sufficient to plant an acre when sown in this manner.

The most satisfactory method of sowing is with a seed drill, as in this way it is possible to get a good even spacing, and no loss of moisture occurs during planting, as is often the case where furrows have to be opened up for hand planting.

Field Practice.

The land may be lightly harrowed even until the plants are a few inches high. This will not only destroy young weed growth, but will also greatly improve germination in the event of heavy rain falling shortly after planting and causing the surface soil to become caked. Many growers are afraid of injuring the young crop, but if harrowing is done on a bright warm day, when the young plants are not brittle, and care is taken to prevent dragging of rubbish which may collect under the harrows, the crop not only will not be injured but will be greatly benefited.

In districts where the rainfall is heavy, and difficulty is experienced in keeping weed growth in check, many growers before planting run out shallow drills a few inches deep with a light plough or other suitable implement, and then sow along the bottom of the drills with the planter. When the young plants are high enough the cultivator is worked through the rows, and is set in such a way that the soil is drawn in around the plants, filling up the depression made when drilling, and thereby smothering the young weeds which have sprung up in the rows. This, of course, to be effective must be done while the weeds are very young.

During the early stages of growth the crop should receive at least two good inter-row cultivations to keep weed growth in check and to keep the surface soil in a nice friable condition, and on no account should the surface soil be allowed to remain in a caked condition while it is possible to work a horse cultivator in the rows.

Harvesting.

The picking of the crop still remains a hand operation, and although machines have been tried, one of which was invented and built in Queensland and which performed well at the trials, none of these has so far reached a stage where it can be successfully worked in the majority of crops.

The ears should be allowed to dry out thoroughly before being shelled, for, apart from the fact that the grain if shelled too early is likely to heat in the bags, a large quantity of grain is broken and damaged during the shelling process and the appearance of the sample is spoiled. A considerable wastage also occurs through the cores being too soft to withstand the pressure of the drums, and these break up into small pieces and pass out through the machine with the grain still attached.

Cost of Production.

To make maize-growing profitable the cost of production has to be reduced to a minimum, and this can only be done by increasing the yields by the use of pure strains of seed which have proved suitable for the locality, and also by practising the best cultural methods. Good quality seed not only gives an increased yield per acre, but also an increased return per bushel, as a better price will always obtain for grain which is of good even type and colour.

The use of modern machinery also is important in lessening the cost of production, and hand work must be eliminated wherever possible; the combined husker and sheller has done a great deal towards this.

Storage.

Maize may be stored for very long periods at no very great cost other than the initial cost of the tanks, yet growers frequently dispose of their entire crops for very low prices during flush seasons; whereas if they had the storage accommodation, and, of course, were in a financial position to store their grain for a time, they would receive very much better prices. One thousand gallon tanks are very suitable for this purpose, and hold approximately 3½ tons of grain. The lids of the manhole and shoot should be so constructed that they can be made quite airtight by puttying or by the use of puddley clay. First and foremost the grain should be dry, and should not contain more than 14 per cent. of moisture at the time it is placed in the tank.

If the grain is showing signs of weevil it can be fumigated by placing a couple of saucers on the top of the grain and pouring into these 1½ to 2 lb. of carbon bi-sulphide. Place the lid on as quickly as possible and puddle up the edges of the manhole cover to make it perfectly airtight. The tank should be kept sealed for twenty-four hours, or longer if desired, and then remove the lids from the manhole and discharge shoot and cover the discharge shoot with strong gauze to prevent the grain from running out. After forty-eight hours the covers can be put back.

Grain for seed purposes should not be left for such a long period, and should immediately after fumigation be exposed to the air, otherwise the germination may be seriously affected.

Carbon bi-sulphide is highly inflammable, and care should be taken to see that no lighted pipe or other naked light is near the tank when the fumes are released.

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E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

PIG raising is now well established over the eastern portion of the State extending from Stanthorpe in the south to the Atherton Tableland in the far north and as far west as Roma, taking in the South Coast, the near North Coast, the Brisbane and Lockyer basins, the whole of the Wide Bay and Burnett, and parts of the Dawson Valley and Central Queensland. Thus, from the far northern highlands, famed for their fertility and generous seasons, right down to the southern border—a stretch of nearly 1,200 miles—pigs are farmed on a commercial scale. Bacon factories—proprietary and co-operative—and meat export works are spaced at convenient intervals throughout the pig-raising country, and continuity of supplies ensures for them a reasonable run of work throughout most seasons of the year, their joint output of bacon and hams for the year 1933 being over twenty million pounds. Thus, in its primary and secondary phases, the pig industry provides a livelihood for populous farming communities, and gives employment to a large number of highly skilled workers.

The principal breeds used are of British origin—the Berkshire, Tamworth, Large White, and Middle White—in the sale of the progeny of which a state of healthy rivalry exists between supporters of the several breeds. This competitive spirit is catered for in the pig sections of agricultural shows throughout the State, and especially at the Brisbane Royal, where the display of stud pigs would stand comparison with that featured at any show here or abroad.

Within the industry ceaselessly working to maintain present efficiency and to effect improvements wherever opportunity offers are a number of organisations—societies representative of all pig industry interests. Especially has the co-operative effort been developed among pig raisers, resulting in the establishment of up-to-date and highly successful co-operative bacon factories both in the metropolitan, Darling Downs, and North Queensland areas. Proprietary factories both on a large and small scale have grown up with the industry, and in more recent years the establishment of the Brisbane Abattoir, and extension of operations there and at other meatworks to provide for the export

trade in frozen pork and for a wider distribution of pork products on the local market, has meant an immense amount to the industry.

Climatic Conditions and Environment.

It is worth stressing here that we are indeed fortunately located from a climatic point of view in comparison with older and colder countries of the world, for our climate certainly favours the open-air system of stock raising; and this system, plus our environment, enables progress to be made with less financial outlay than where winters are long and cold and more intensive housing and feeding is necessary.

Doubtless it is this, plus strict quarantine measures, that has kept the country free of such scourges as foot and mouth disease, trichinosis, pork measles, rinderpest, swine fever (hog cholera), swine erysipelas, and other serious pig diseases.

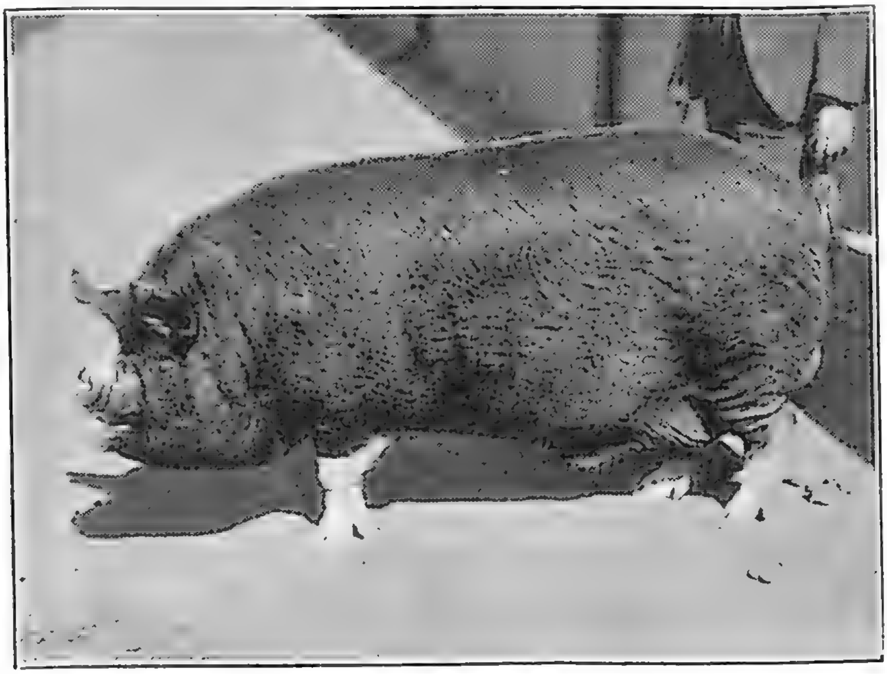


PLATE 35.

The Champion Berkshire Boar at the Sydney Show, 1934. Now the property of Mr. J. Barkle, of Kingaroy. This boar has already added to his laurels by winning several championships in keen competition in Queensland.

With such a favourable environment, it is not to be wondered at that the industry has developed so remarkably and that the good reputation of Queensland's pork products, and especially frozen pork, on the overseas markets is being well maintained.

A favourable location, reasonably good seasons, and a constant and expanding market for the products of the business are all essential to the progress of primary industry, and as Queensland is possessed of all these attributes she ranks to-day as the foremost pig-producing State of the Australian Commonwealth.

As with other branches of rural industry, the production of pigs is a specialised business, requiring knowledge and application.

Fortunately, the business is not one requiring a large amount of capital or an expensive outfit or plant, particularly where it is associated with dairying and general farming; the provision of abundant supplies of suitable foods, a liberal water supply, clean, comfortable accommodation, and necessary utensils are among the principal requirements.

To the specialist who intends devoting the whole of his time to pig raising on the intensive system, as in the case of buttermilk piggeries, and suburban pig farms, the business runs along different lines to the combination of cows and pigs associated with dairying.

Apart from the financial side of the proposition, it is essential that there be continuous attention to factors that determine profit and loss in the carrying out of pig farm activities.

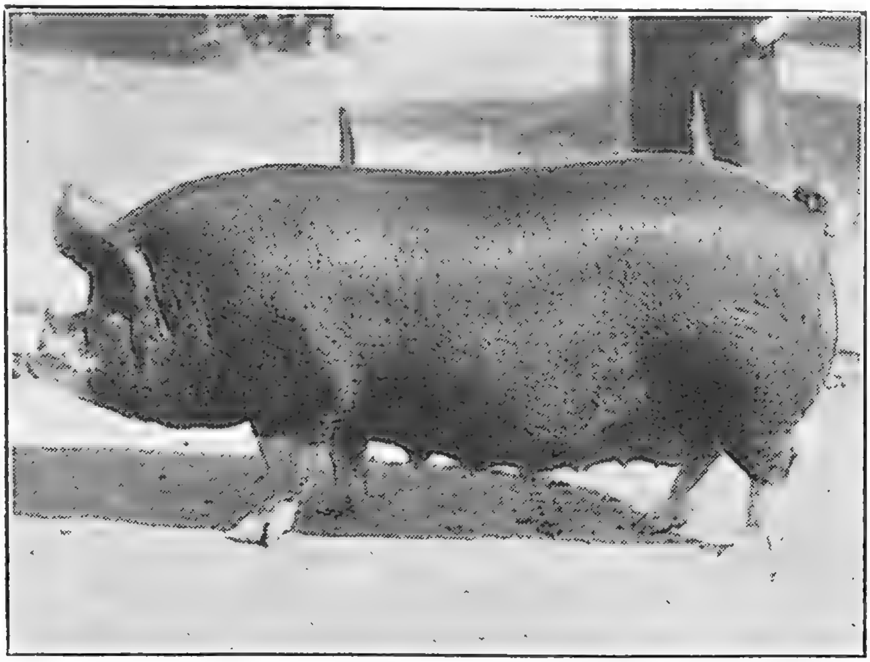


PLATE 36.

The Champion Berkshire Sow at the Royal Easter Show, Sydney, 1934. Parnell Queen 2nd. Shown by the Riverina Welfare Farm for Boys. A daughter of this sow was purchased for Mr. H. B. Kerner, of Queensland, at the Show sales.

Experience has proved that the man, his methods and capital, play the most important part in this venture. A suitable farm, fertility of the soil, rainfall, and climatic conditions are all essential to success.

It has, however, become almost an axiom to say that success depends largely upon production and utilisation of necessary food supplies on the farm, although it is wise to remember that there is always a definite place in stock rations for commercial meals, concentrates, and minerals.

Thus, the food supply and its relationship to seasonal rainfall play an important part. It is essential to remember that the particular requirements of local, interstate, and overseas markets catered for will determine, to an extent, the class of stock kept and the methods of management.

Similarly, marketing facilities, pig prices, and prospective supply and demand are all problems that range before the farmer as he "plans his work" and "works his plan."

Systems of Pig Raising in Queensland.

Long experience has demonstrated that of the various systems of pig raising in operation the most popular, and perhaps that entailing the lowest expenditure, is the system of pig raising in conjunction with dairying in which skim milk and other dairy by-products form the major portion of the food used. This system combines the feeding of dairy products, farm-grown grain, roots, and greenstuff, with some concentrates, and is mostly regarded as the safest and surest road to profit in the keeping of pigs.

More than 90 per cent. of the pork produced in Queensland could be classed as "dairy-fed pork," a food product in universal demand the world over at a premium. Climatic conditions, while variable in regard to rainfall in most of our subtropical districts, are certainly conducive to extension of dairying and mixed farming and to the production of healthy stock under conditions that favour good growth and early maturity. It is worthy of note also that where pigs are kept in conjunction with dairying and mixed farming a comparatively small capital is required to add pigs to the other farm stock. There is little or no risk in so doing, for there is always a ready market for all saleable stock.

Statistics indicate that pigs are particularly healthy in Queensland, and that climatic conditions, being equable, are specially suited to open-air systems.

The system of producing pigs in conjunction with the growing of corn, wheat, barley, oats, and grain sorghums for grain has proved profitable from the mixed farmer's point of view.

This system, combining grain farming with stock raising, is more dependent upon seasonal conditions where circumstances do not permit of conservation of grain and hay and provision of additional root crops.

Pig-feeding experiments now being carried out at the Animal Health Station at Yeerongpilly, in which certain pigs are being fed on a diet from which milk is entirely excluded, have been planned to demonstrate the commercial possibility of feeding pigs with protein meal in lieu of skim milk or any other dairy product in conjunction with home-grown cereals; and that pigs can be produced profitably on farms where the growing of grain, root, and green crops are the main activities, and where dairying is not practised to such an extent as to justify pig raising if dependent on skim milk, buttermilk, or whey as a basic food.

From an export point of view, it is considered there are great possibilities associated with systems of pig raising that combine the use of vegetable and animal proteins as suggested, for, owing to variable climatic conditions over different seasons and at different periods of the year in the dairying districts, there is a marked variation in the number of pigs coming forward monthly for treatment at bacon factories, abattoirs, and meatworks. As will be understood, such fluctuation in supply is prejudicial to the exporter, whose aim must be continuity and sufficiency of supply.

Similarly, it is probable that if there were less dependence upon milk as a food and greater extension of the use of cereals (carbohydrates), plus vegetable and animal foods (proteins), the pig industry would be placed on a safer foundation and expansion of local and export trade would be expedited.

In other words, these feeding experiments aim "to provide data relative to pig nutrition and for purposes of pathological experiments in the feeding and handling of market pigs, and to provide suitable stock for marketing as export porkers or baconers in co-operation with the Queensland Meat Industry Board."

The system of pig raising in conjunction with manufacture of dairy products, in which pigs are fed on factory by-products—buttermilk (or whey)—and on grain, greenstuff, minerals, and water, occupies a very important place in the economic life of the industry, and thousands of pigs are fed and marketed each year from commercial pig farms of this type.

Pigs bred on farms where they are fed on waste food from hotels, cafés, produce markets, and manufacturing establishments contribute a liberal quota each year to pig industry statistics, and have their place in the economy of the industry. Although this system is not at present as extensively carried out in Queensland as in the more populous southern States, there are numerous suburban and metropolitan piggeries around Brisbane and provincial cities. The two lastmentioned systems require larger capital and a wider knowledge of methods of feeding and handling, but under expert control are profitable and are capable of expansion. Suburban pig farming is, however, a business necessitating long hours and considerable labour and expense in collecting food, and unless conducted on specialised lines might readily become unprofitable or a mere "pot boiler"; thus it is often associated with the keeping of poultry as a side line.

Stud pig breeding requires special knowledge and the application of business principles even more so than any other branch of the industry, for unless the stud pig specialist is a business man or woman, and conducts the business on strictly business lines, it is unlikely as such to be successful. The cash capital required depends entirely upon the scope of operations, though stud pig breeding has its limitations, and is ordinarily more profitable when carried out in conjunction with one of the other systems referred to. There is plenty of scope for enthusiastic and capable farmers to further develop this class of stock raising, and the success of those primarily engaged in the business should be an incentive to others. The stud pig breeder needs to co-operate and advertise just as the commercial pig man must organise, and while the former must rank as a member of the Australian Stud Pig Breeders' Society, the latter should not overlook the importance of those organisations at work in the interests of the industry as a whole.

This list of systems of pig raising would not be complete without reference to the many enthusiastic and progressive members of Senior and Junior Pig Clubs, whose operations, while conducted on a limited scale, are, nevertheless, of importance to the industry. As members of the Stud Pig Breeders' Society increase in number, and there is a wider distribution of purebred stock, so also will there be increased interest among the juniors, many of whom will eventually become farmers, following up their project, and becoming the owners of more better-quality pigs and other stock.

Piggery Management.

It is again emphasised that the most progressive pig farmers in Queensland are those who practise and aim at efficiency and whose farms and piggeries are models of cleanliness and well-thought-out method.

Efficient management is an important factor in the success of every undertaking; hence as pig raising is a business venture it must be conducted efficiently to be profitable and worth while.

Nominally, the farmer must have as complete a practical and a theoretical knowledge of the business of pig raising as is possible. It is noticeable, nevertheless, that many farmers who have had little or no schooling in other than the practical side of the business are very often the most successful, for without doubt they have an inborn knowledge of the job.

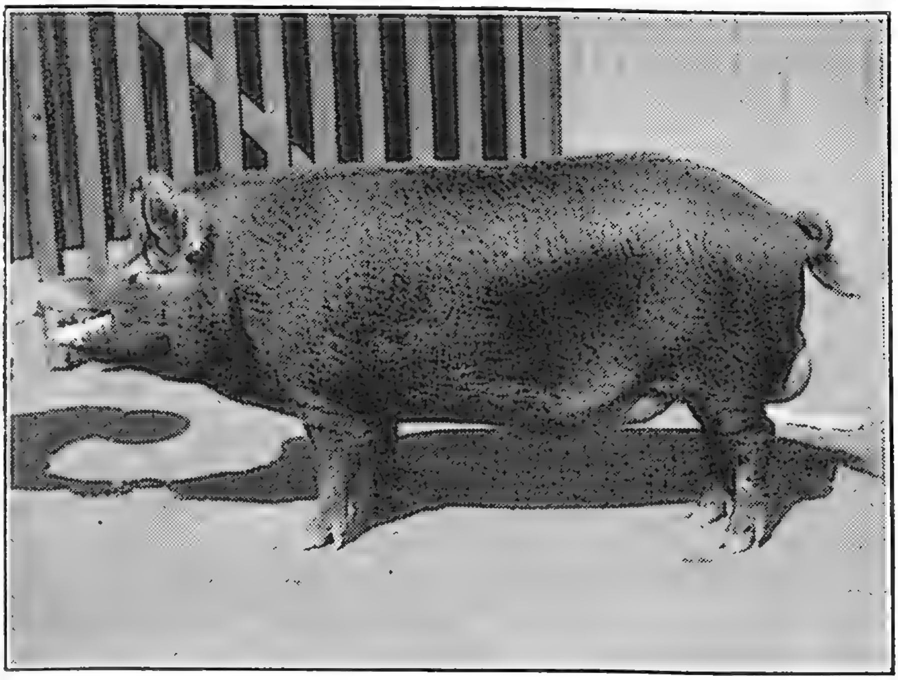


PLATE 37.

A. N. White's Champion Tamworth Boar, Sydney Show, 1934. This boar, Blakeney Tom, carries blood of strains that have been successful over a long period of years.

When pig raising is combined with dairying, it will be found as a workable rule that one breeding sow to every ten cows in milk will suffice. In other systems one sow per acre of good cultivation land will be about the correct proportion, with one boar to every fifteen sows kept. If accomomodation, capital, and additional food supplies are available, or if other phases of pig raising are also catered for, it may be possible to increase the number of pigs kept; actually it is better to have food to spare than to lose money by having more pigs than can be comfortably fed and profitably reared.

Experience proves that the Queensland farmer milking sixty cows comfortably handles six sows and one boar together with young pigs, provided some additional food is grown or purchased to supplement the

milk. Breeding stock should not be used for stud purposes until they are approximately ten months of age. After that, if they are carefully handled and kept in reasonable breeding condition, both boars and sows should be productive up to the age of six years or, perhaps, a year or two more. Some authorities prefer and suggest culling all breeders after they pass the age of three or four years.

Whatever happens, correct feeding and management are essential. Pigs necessarily consume large quantities of nutritious food to enable them to develop and mature early, for as baconers to reach 170 lb. live weight in 170 days from birth (birth weight about 2 lb.), and with a ratio of approximately 3 to 4 or possibly 5 lb. of food (dry matter), plus water, to each pound of pork produced, the modern pig is, indeed, as it has been styled, a "pork-producing machine" which must be bred, fed, and properly controlled in order to prove profitable.

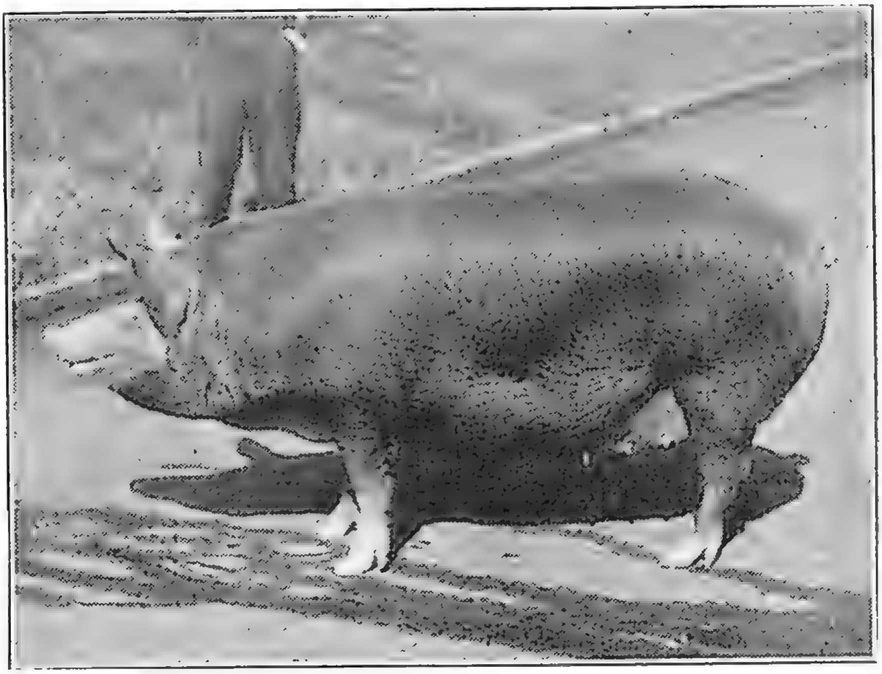


PLATE 38.

The Champion Tamworth Sow at the Sydney Show, 1934. The property of J. A. Murray. This sow, Kolodong Success, comes from noted prize-winning strains, and is herself a typical representative of the breed.

Good-quality breeding sows are procurable in Queensland at from £4 4s. at twelve to sixteen weeks of age to about £12 12s. each or so as sows ready for service or in-pig sows. Pedigreed boars are available at from £4 14s. 6d. at three months old to £12 12s. or so as yearlings ready for immediate use.

It has been remarked that in stock raising "half the breeding is in the feeding." It might be stated as equally true that in pig breeding it is impossible to expect good results from feeding inferior quality, slow-growing strains of pigs. A good sow mated to a superior quality boar will produce pigs worth twice as much as those produced by mongrel stock, while cost of production is lower in the former than in the latter. It is not to be expected that pigs will grow rapidly and

produce profitable returns unless improved breeding and selection go hand in hand with correct feeding and management.

Fortunately, fewer farmers keep unprofitable pigs now than formerly. Nevertheless, the pig industry still suffers considerable economic loss each year through the retention on farms of unsatisfactory breeding sows—i.e., sows only producing one litter of less than eight pigs per year instead of two of more than eight each—and also through the use of crossbred, mongrel, lazy, and unproductive boars.

The business of the pig farmer is, and always must be, to help the pigs in their progress from birth to factory, and to feed, handle, and market them in the most attractive and desirable form.

To be profitable, breeding sows should produce two litters per year of no fewer than eight and preferably ten or twelve pigs per litter. There are many sows producing litters of from ten to fourteen, and as it is possible to procure such sows as these it is not an economic proposition to be content with sows that regularly produce six to eight pigs per litter only. We must revise our ideas on these matters and realise that the breeding of productive pigs is a science and an art and not a common unbusinesslike farmyard practice. Unfortunately, too many farmers still depend almost entirely on the purchase of store pigs, and for these, at times, abnormally high prices are paid, and the margin of profit in finishing them for slaughter is considerably reduced.

It is desired to stress more dependence on breeding the pigs on the farm and not so much dependence on purchasing, although if properly conducted there is good profit for both parties in a well-conducted store pig business. The purchase of store pigs at high prices for sale later as baconers at an uncertain value is not usually in the best interests of either party, nor are the risks involved to be recommended.

For the purposes of marketing organisation, co-operative and proprietary bacon factories, meat export works, butchering and trading establishments generally have their place, and much success has attended their efforts. In fact, it is often remarked that if and when the farmer is as efficient at his job as the tradesman, the bacon curer, the small-goodsman, and the factory manager, this industry will be regarded as the safest of all agricultural ventures and not the least profitable. There is, of course, much in the way of improvement that can and must be effected at the production end, but attention to marketing requirements by individual pig raisers is actually the first step in effective marketing organisation. In this connection, as in every other phase of the industry, the helping hand of Departmental officers is available on request, and every assistance is gladly and willingly rendered.

If you like this issue of the Journal, kindly bring it under the notice of a neighbour who is not already a subscriber. To the man on the land it is free. All that he is asked to do is to complete the Order Form on another page and send it to the Under Secretary, Department of Agriculture and Stock, together with a shilling postal note, or its value in postage stamps, to cover postage for twelve months.

Poultry in the Orchard.

By P. RUMBALL, Poultry Expert.

THAT poultry raising and fruitgrowing can be combined profitably has already been proved in different parts of the State. With the fowls, the natural conditions in the orchard in the form of range, food, and shade make for good health in the flock; while the birds in turn benefit the fruit trees by keeping down weeds and insect pests, besides contributing a modicum of fertilizer to the soil.

Benefit of Fowls in the Orchard.

In the illustrations used in this article the absence of weed growth in the orchard will be noticed. This is not due to intense cultivation that is generally necessary, but to the presence of poultry. The owners of the farms where these pictures were taken assured the writer that before they kept fowls they were constantly cultivating and that now cultivation is only practised to loosen up the soil for the conservation of moisture. The keeping in check of weed growth means much to the orchardist, while to the fowls it serves as an article of diet which is highly necessary for the maintenance of good health.

Insect Pests.

The fruitgrower knows probably better than I do the large numbers of insect pests which are detrimental to his industry, and that many of them, such as pupæ of the fruit fly, &c., hibernate in the soil. Caterpillars, grasshoppers, crickets, and beetles of many descriptions, which cause damage to fruit and trees, fall easy victims to poultry, while the fowls' habits of dust bathing themselves in the shade of the trees tends to keep the soil loose and prevents the undue growth of surface roots.

Manurial Value.

Another advantage in keeping fowls in conjunction with fruitgrowing is that the manure is distributed throughout the orchard. The grower knows what it costs to manure per acre or what it should cost, but he does not always recognise the value of fowl manure. The quantity voided varies to some extent, of course, with different types of fowls and the method of feeding.

From a report published in the Journal of the Ministry of Agriculture of Great Britain of data collected at the College Poultry Farm, Theale, Reading, the following figures are taken:—

QUANTITIES VOIDED BY DIFFERENT BIRDS.

Kind of Fowl.	Weight.		Manure Voided Weekly.		Percentage of Body Weight.	Manure Voided per Bird per Annum (Fresh).	Number of Birds to Void One Ton per Annum (Fresh).
	Lb.	oz.	Lb.	oz.		Lb.	
Wyandotte cock ..	6	12	1	13	26·8	94½	24
Faverolle hen ..	5	12	1	11¼	29·6	88½	25
Growing chicken, 14 weeks	3	12	1	2½	30·8	..	..

The breeds principally used for egg production in Queensland are not shown, but it will be seen that the laying hen and the growing chicken void a greater percentage than an adult male bird, and with high-producing birds, such as the Leghorn and Orpington, a conservative estimate would be 30 per cent. of live weight voided weekly; therefore, a 4-lb. Leghorn would void per annum 62¼ lb. and a 5-lb. Australorp 78, while it would take thirty-seven Leghorns or twenty-nine Australorps to void a ton.

Composition of Fresh Poultry Manure.

The analysis of poultry manure varies with feeding, but that from stock fed on lines usually adopted for the maximum production should comply very closely to the following:—

Moisture.	Dry matter.	Nitrogen,	Phosphoric acid.	Potash.
59·50	40·50	1·47	·71	·49

The commercial value of this manure based on its unit value is from 20s. to 35s. per ton, and the running of 200 fowls or slightly less per acre would be the means of manuring the land to the value of £5 to £7 10s. However, its principal property being nitrogen some will be lost owing to its volatile nature, but there is in addition to the principal concentrates the organic matter—material which is an improvement to all soils.

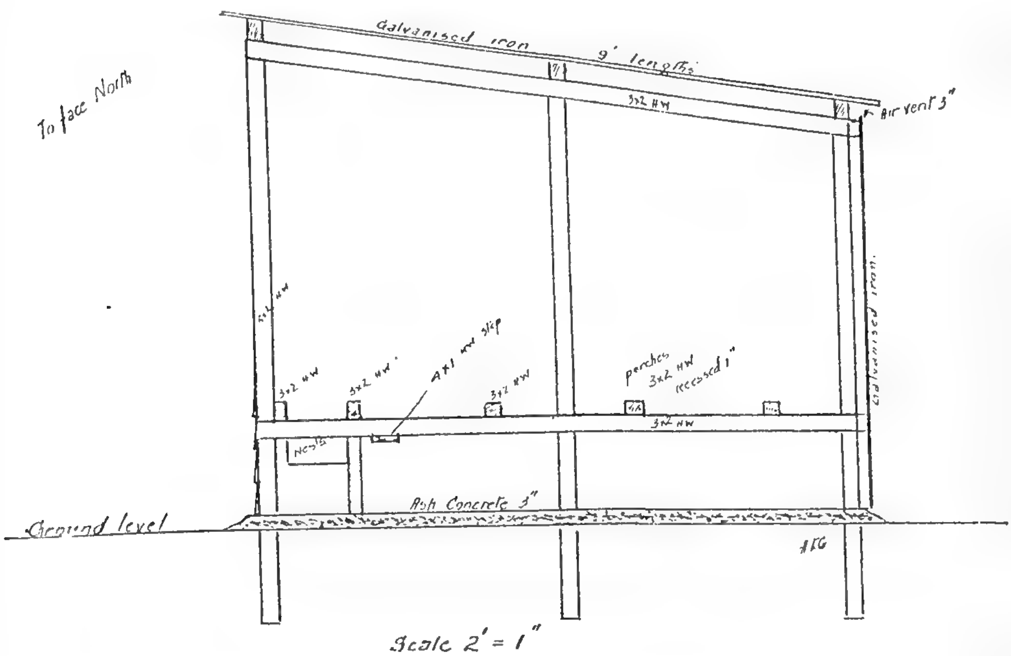


PLATE 39 (Fig. 1).

Additional financial returns will depend largely upon the class of stock kept and the attention bestowed on them. Although they will save the grower many days' labour in cultivation, spraying, &c., they will demand daily attention, and to the producer who is not inclined to give them this attention they are not recommended. Only the best should be kept. The breeding, rearing, and feeding should receive the same attention as the poultry farmer devotes to this work, as it is only by these

means that the maximum results will be obtained. Generally speaking, each hen should return a profit over cost of feed, when kept in the vicinity of Brisbane, of about 5s., and 150 to 200 could be run per acre. This, in conjunction with the usefulness of the birds as pest destroyers and the manurial value of their voidings, should prove an incentive to fruitgrowers to work along these lines.

Making a Start.

Although the foregoing may appear attractive, in making a start, caution should be observed. The work of keeping poultry has to be fitted in and the great majority have to gain the experience essential for the rearing of young stock and the feeding of layers. A start should be made by the erection of a poultry house on the lines outlined in the plans, figs. 1, 2, and 3. This house can be used with the addition of a brooder. After the brooding stage it can be used as a rearing house, and ultimately serve its original purpose of housing the adult laying stock. The rearing of chickens in quarters used for adult stock is not usually recommended, but under the conditions of range in the orchard soil contamination does not occur to any great extent.

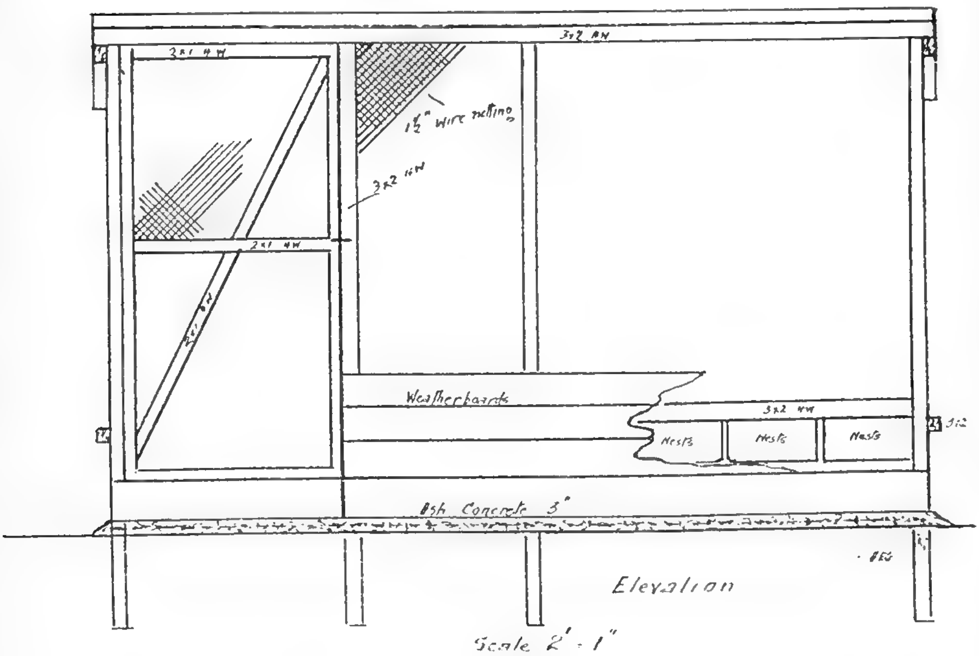
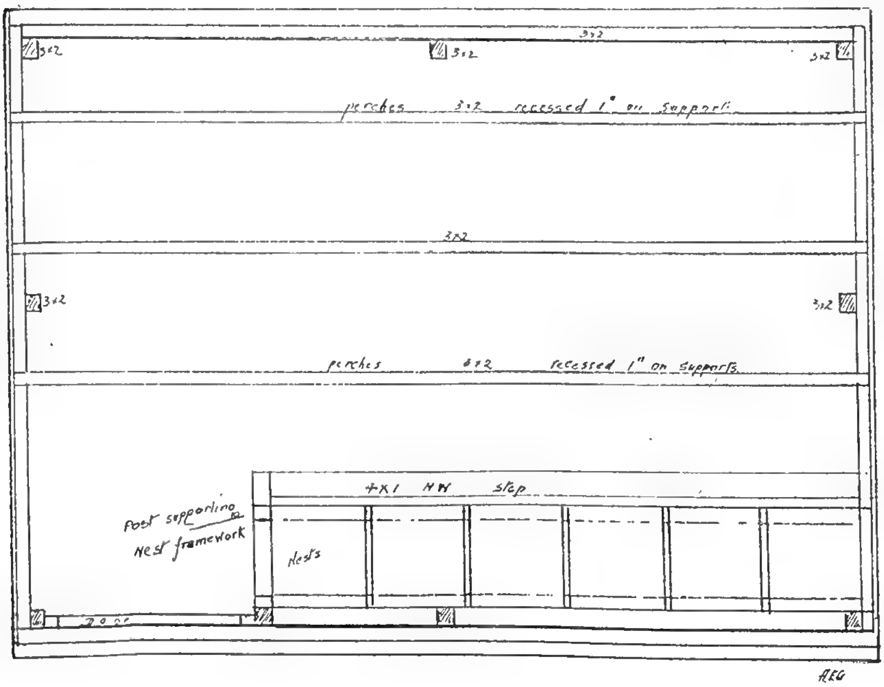


PLATE 40 (Fig. 2).

The purchase of day-old chickens should then be made from some reputable breeder, and so save the necessity of buying breeding stock and the work entailed in incubation. By doing this the number of chickens you have for a start are definite, they will be of the same age, which facilitates rearing and prevents the period of rearing being unduly prolonged and becoming irksome. In making the purchase, be sure and go

to a reputable breeder who maintains the qualities of both numbers and size of eggs in his stock.

Possibly the best months for securing chickens is during August and September. Earlier chickens can be made use of if it is desired to have two lots during the one season, and so allow the first lot to get off your hands before a second lot is commenced with, say, in September.



Ground Plan.

Scale 2' = 1"

PLATE 41 (Fig. 3).

Netting partitions to keep various ages separate may be erected at convenient spaces if desired, but they interfere with the cultivation of the orchard and are not absolutely essential. If chickens are reared in a special house and confined for two or three weeks within a temporary fence they will invariably return to their own quarters to camp. Larger houses than shown in the plan may be built, but units of fifty placed at intervals about the orchard will ensure a better distribution of the birds' droppings and incidentally will cause the birds to forage over the whole of the orchard.

The system of feeding adopted may be either wet mash in the morning and grain at night, or dry mash in hoppers, which is before the birds all day, and grain at night or all mash. The latter system, especially to the novice and to the grower who desires to reduce his work is recommended. The birds by this means are assured of getting all the food they require for egg production, while the grower is relieved of much work daily.

PLATE 42 (Fig. 4).—PAPAWS AND POULTRY.

The luxuriant growth here seen is, to a very large extent, undoubtedly due to the fertilizing value of the poultry manure. The soil is of a light loamy nature, and not naturally rich in plant food.

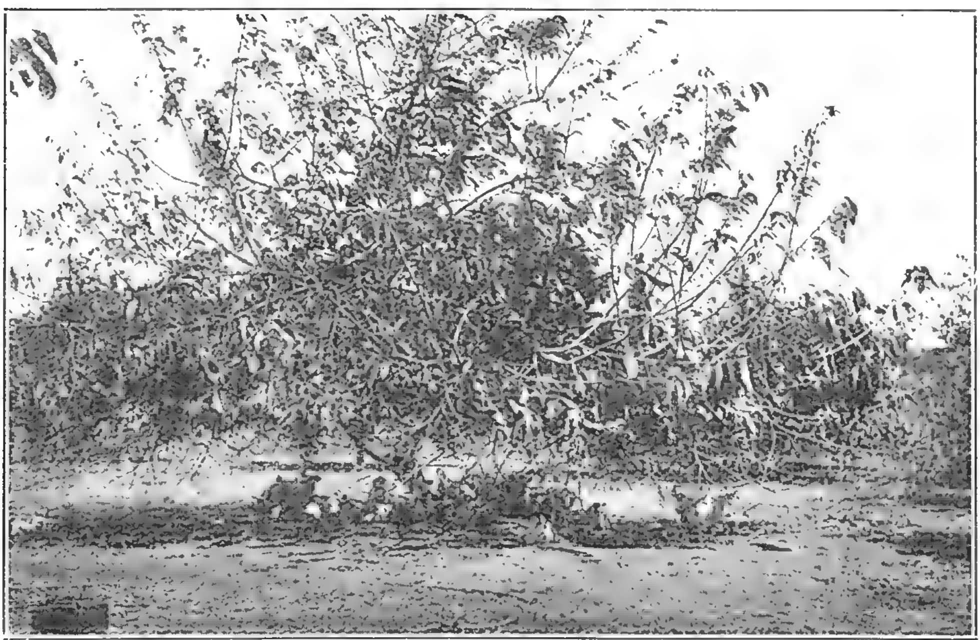


PLATE 43 (Fig. 5).—POULTRY IN THE SHADE OF A CUSTARD APPLE TREE.

This class of fruit tree offers a maximum amount of shade to poultry in summer.

Reference to the plan, figs. 1, 2, and 3, plainly indicate the simple nature of the house suggested for the purpose of housing fifty laying hens. It is simple in structure, being open fronted, roofed, and walled at back and ends with corrugated iron. A 3-inch open space is provided between the top of the back wall and roof to permit of a good circulation of air. In front weather boards are used as a shield to the nests, the balance being netted in to allow of the stock being protected from predatory animals during the night. The nests are made from petrol tins, one side of which, with the exception of $1\frac{1}{4}$ inch, is removed. This is then turned at right angles to prevent the tin falling through the nest framework. Three perches are shown, 3 by 2 hardwood being used. This is placed on edge and the top corners slightly champered. They are supported on the bottom batten, and by being recessed to the depth of an inch are perfectly firm, and at the same time are easily removed for cleaning purposes.

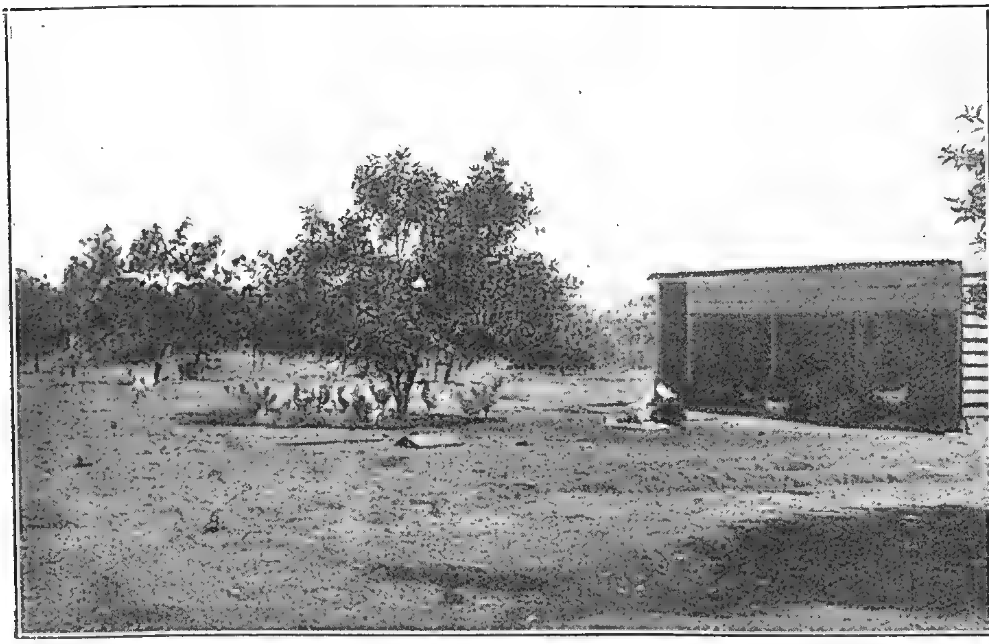


PLATE 44 (Fig. 6).

Citrus fruit growing and poultry keeping is commonly practised in different localities. The benefits to this particular farmer of the combination have been less work and greater returns.

The floor is raised to the extent of 3 inches above ground level to ensure dryness. Concrete is recommended, being readily cleaned and it does not become saturated with droppings. Earthen floors become foul and require renewal at frequent intervals.

The lines suggested on which a start should be made are economical as regards permanent fixtures and equipment, and also relieve the producer for the time being of establishing breeding pens, the necessity of purchasing incubators, and becoming acquainted with the operations of an incubator.

For further information on feeding obtain the Departmental leaflet on this subject.

Marketing Oranges at Home and Abroad.

By JAS. H. GREGORY, Instructor in Fruit Packing.

(*Continued from page* 666, Vol. XLI., Part 6—June.)

PART II.

Packing the Standard Box.

THE Standard Box (18 inches long by 11½ inches wide by 10½ inches deep) is very easy to pack when made correctly. The timber for this box should be milled so that the sides of the box are cut to a minimum thickness of five-sixteenths of an inch. The bottoms and tops should be cut three-sixteenths of an inch thick to allow a bulge to be placed on the finished case without injuring the fruit. This thin timber is prevented from splitting by cleats nailed across the ends of the boards, driving the nails through both the cleat and the bottom and top whilst making and lidding the case. The Standard Case should have a bulge in the centre of 1 inch to 1½ inches on the top and bottom of the case when packed and lidded.

Table "C."

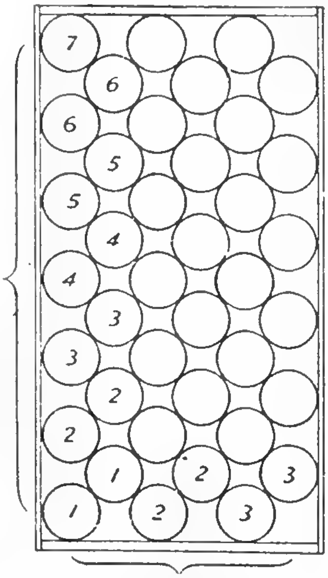
A simplified table of packs to use when packing the Standard Box is as follows:—These packs will give the correct bulge on the top and bottom of the case when the timber for the tops and bottoms is cut to the correct thickness of three-sixteenths of an inch:—

Approximate Size.	Pack.	Layer Count.	Number of Layers.	Total.
2¼ inches	3-3	7-7	6	252
	3-3	7-6	6	234
	3-3	6-6	6	216
	3-3	6-5	6	198
2½ inches	3-3	5-5	6	180
	3-2	7-7	5	175
	3-2	7-6	5	163
2¾ inches	3-2	6-6	5	150
	3-2	6-5	5	138
	3-2	5-5	5	125
3 inches	3-2	5-4	5	113
	3-2	4-4	5	100
3¼ inches	2-2	6-6	4	96
	2-2	6-5	4	88
	2-2	5.5	4	80
3½ inches	2-2	5-4	4	72
	2-2	4-4	4	64
3¾ inches	2-2	4-3	4	56
	2-2	3-3	4	48

It is preferable to use a 3–2 pack instead of a 3–3, as the 3–2 pack will have smaller pockets, and will look better when opened. The same rule applies in using a 2–2 pack instead of a 3–2, when the same fruit can be packed both ways.

HOW TO READ AND USE THE PACKING TABLE.

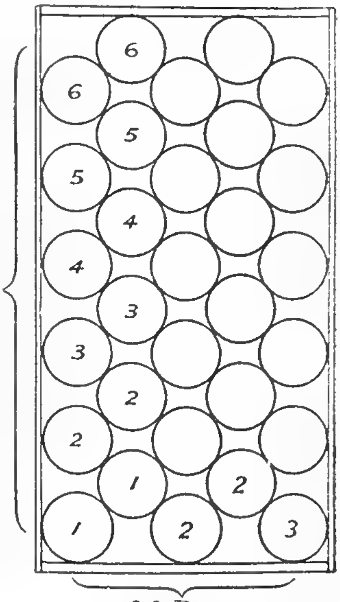
The Layer Count is obtained by counting in the first layer two alternate lines of fruit from end to end in the case, this layer count being 7 x 6.



3-3 PACK.

The Pack gets its name from the way the first six fruit are placed in the layer. The Count is made of the first two lines of fruit across the case.

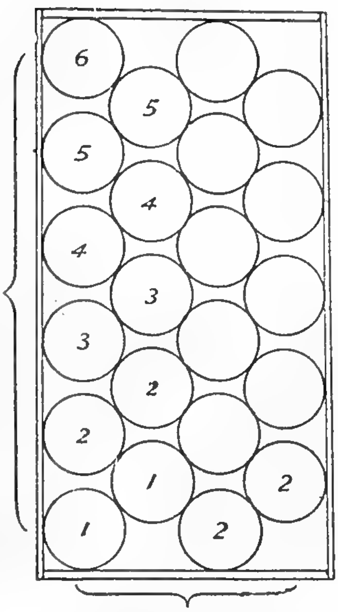
The Layer Count is obtained by counting in the first layer two alternate lines of fruit from end to end in the case, this layer count being 6 x 6.



3-2 PACK.

The Pack gets its name from the way the first five fruit are placed in the layer. The Count is made of the first two lines of fruit across the case.

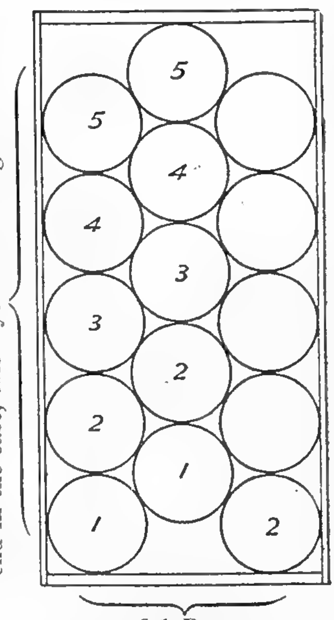
The Layer Count is obtained by counting in the first layer two alternate lines of fruit from end to end in the case, this layer count being 6 x 5.



2-2 PACK.

The Pack gets its name from the way the first four fruit are placed in the layer. The Count is made of the first two lines of fruit across the case.

The Layer Count is obtained by counting in the first layer two alternate lines of fruit from end to end in the case, this layer count being 5 x 5.



2-1 PACK.

The Pack gets its name from the way the first three fruit are placed in the layer. The Count is made of the first two lines of fruit across the case.

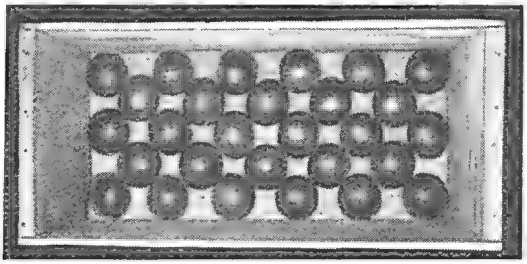
PLATE 45.

AUSTRALIAN DUMP CASE.

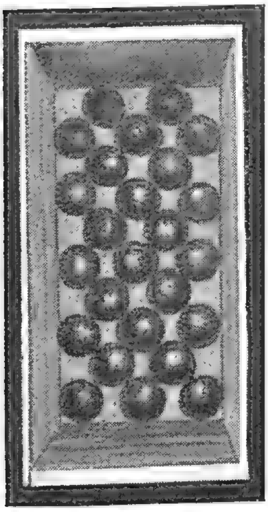
TABLE A.

First Layer.

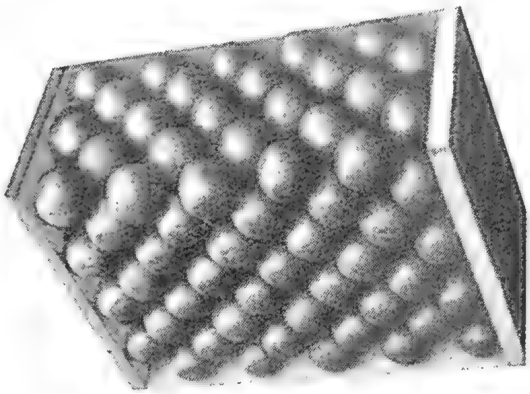
3-2 Pack, 6 x 5 Layer Count, 8 Layers: total, 220 Oranges.



3-2 Pack, 5 x 5 Layer Count, 8 Layers: total, 200 Oranges.

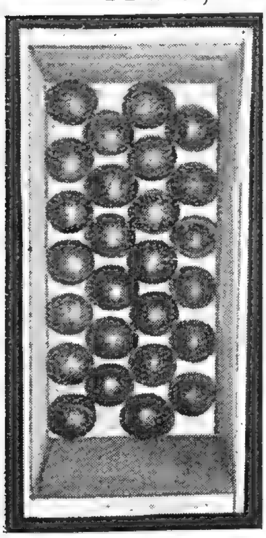


First Layer.

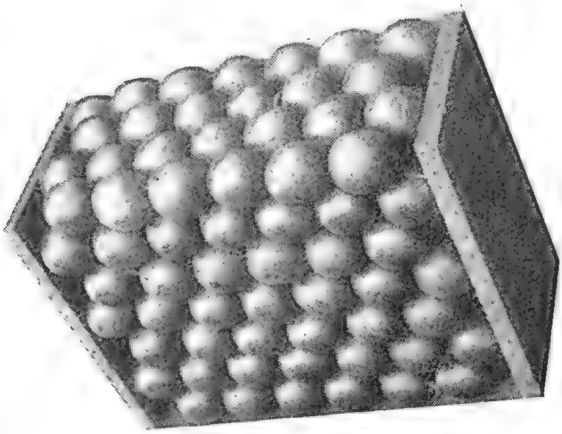


Finished Case. 200 Count.

2-2 Pack, 6 x 5 Layer Count, 7 Layers: total, 182 Oranges.



First Layer.



Finished Case. 182 Count.

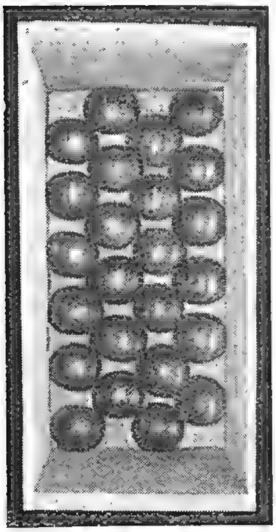
2-2 Pack, 7 x 6 Layer Count, 7 Layers: total, 182 Oranges.

PLATE 46.

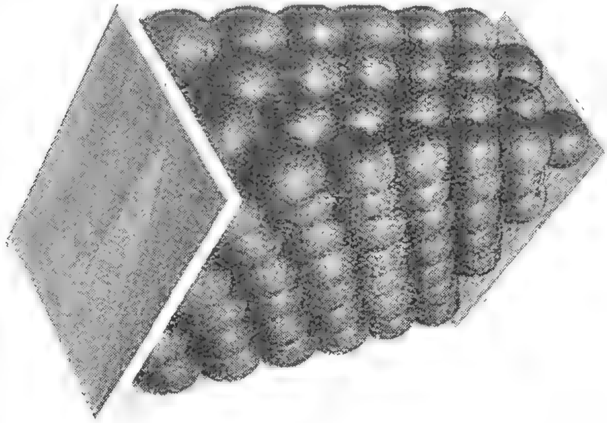
AUSTRALIAN DUMP CASE—*continued.*

TABLE A.—*continued.*

2-2 Pack, 6 x 6 Layer Count, 7 Layers: total, 168 Oranges.

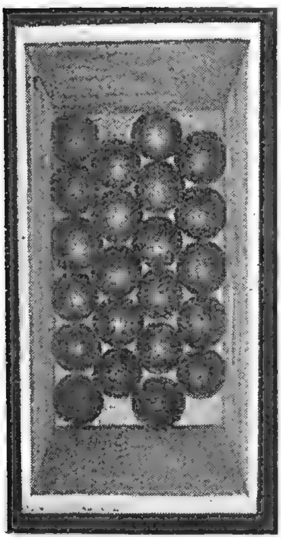


First Layer.

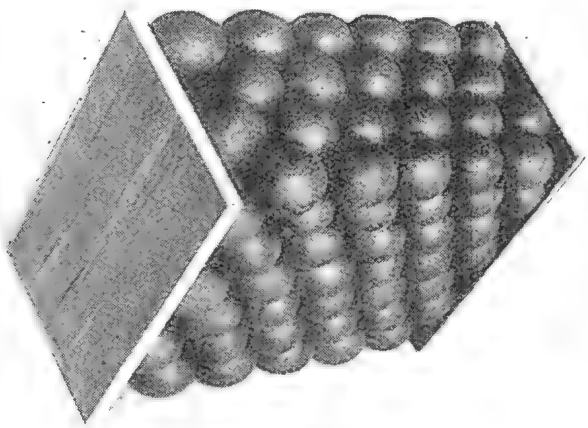


Finished Case. 168 Count.

2-2 Pack, 6 x 5 Layer Count, 7 Layers: total, 154 Oranges.



First Layer.



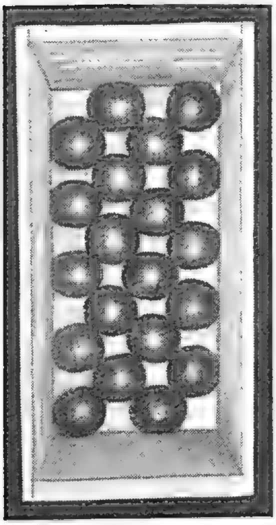
Finished Case. 154 Count.

PLATE 47.

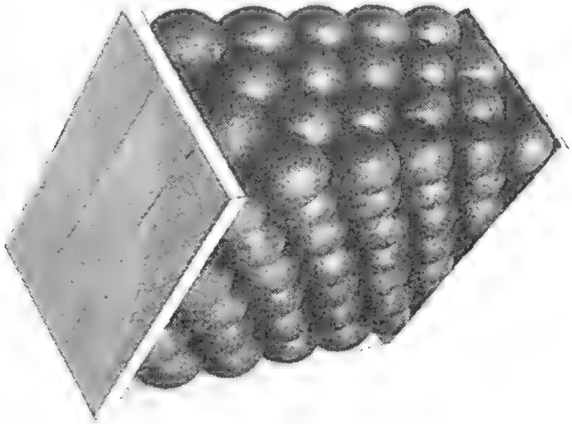
AUSTRALIAN DUMP CASE—*continued.*

TABLE A.—*continued.*

2-2 Pack, 5 x 5 Layer Count, 7 Layers: total, 140 Oranges.

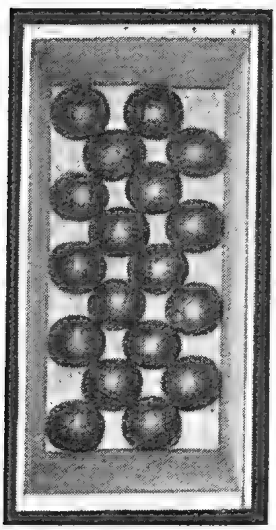


First Layer.

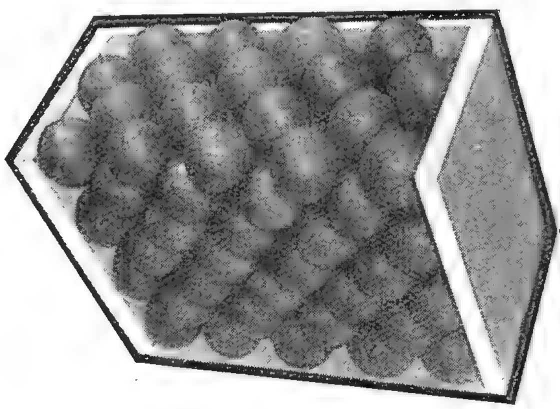


Finished Case. 140 Count.

2-2 Pack, 5 x 4 Layer Count, 7 Layers; total, 126 Oranges.



First Layer.



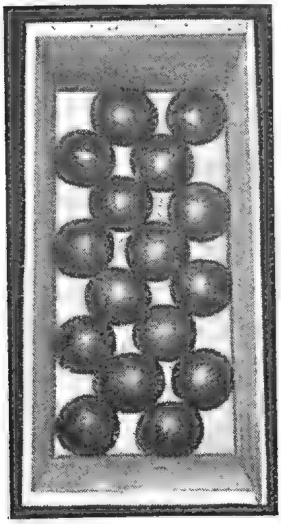
Finished Case. 126 Count.

PLATE 48.

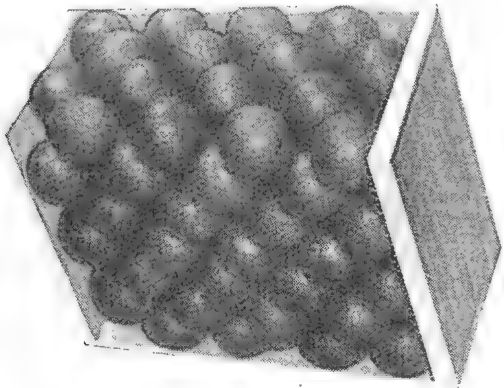
AUSTRALIAN DUMP CASE—*continued.*

TABLE A.—*continued.*

2-2 Pack, 4 x 4 Layer Count, 7 Layers: total, 112 Oranges.

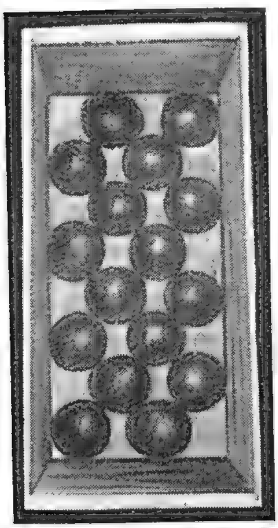


First Layer.
See note on 96 Count.

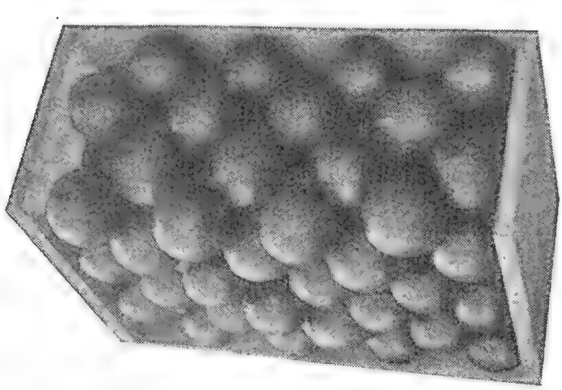


Finished Case. 112 Count.

2-2 Pack, 4 x 4 Layer Count, 6 Layers: total, 96 Oranges.



First Layer.



Finished Case. 96 Count.

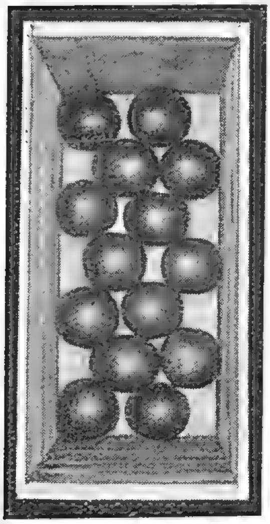
NOTE.—The same number of fruit is contained in each layer of both 96 and 112 Counts, the difference in the packed case being the number of layers—96 containing 6, 112 containing 7.

PLATE 49.

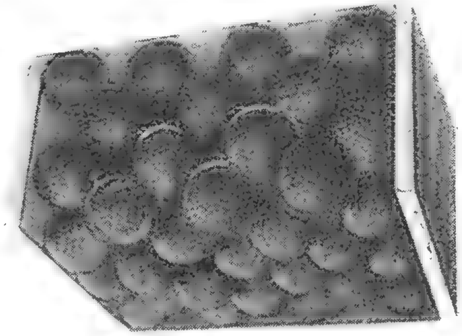
AUSTRALIAN DUMP CASE—*continued.*

TABLE A.—*continued.*

2-2 Pack, 4 x 3 Layer Count, 6 Layers: total, 84 Oranges.

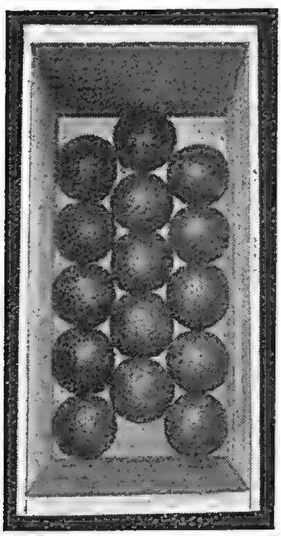


First Layer.

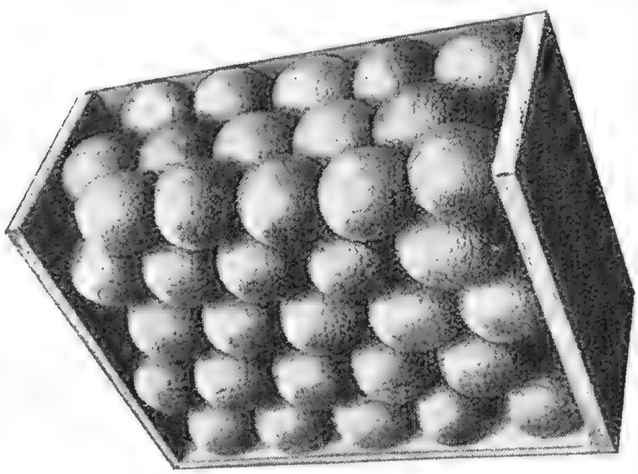


Finished Case. 84 Count.

2-1 Pack, 5 x 5 Layer Count, 5 Layers: total, 75 Oranges.



First Layer.



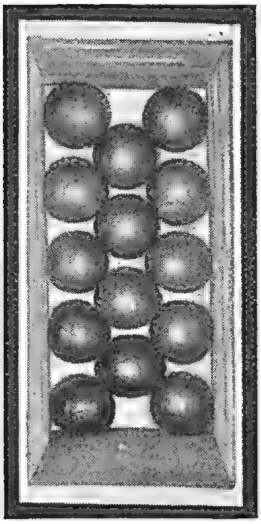
Finished Case. 75 Count.

PLATE 50.

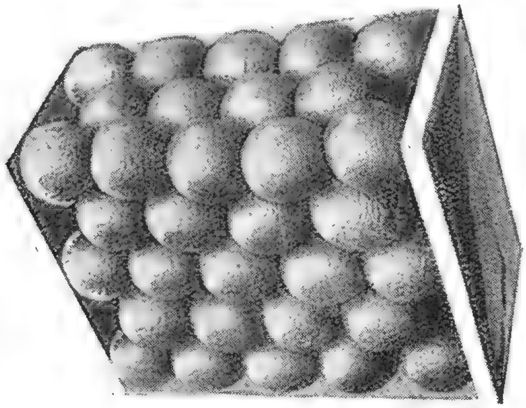
AUSTRALIAN DUMP CASE—*continued.*

TABLE A.—*continued.*

2-1 Pack, 5 x 4 Layer Count, 5 Layers: total, 68 Oranges.

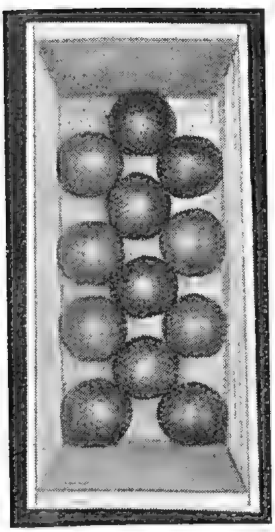


First Layer.

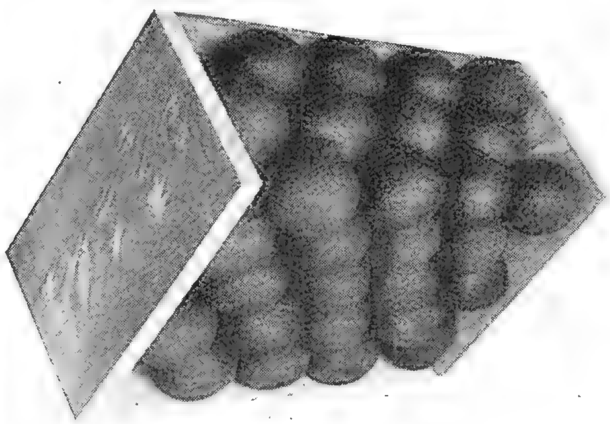


Finished Case. 68 Count.

2-1 Pack, 4 x 4 Layer Count, 5 Layers: total, 60 Oranges.



First Layer.



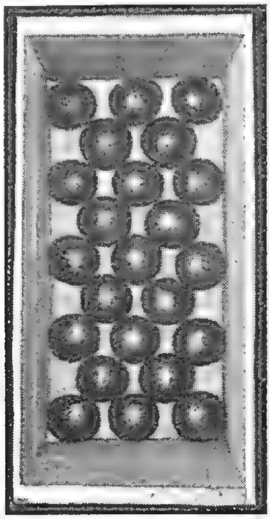
Finished Case. 60 Count.

PLATE 51.

AUSTRALIAN DUMP CASE—*continued.*

TABLE B.

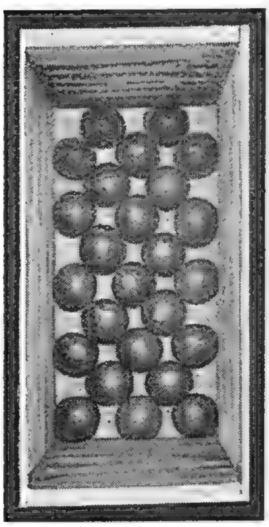
3-2 Pack, 5 x 4 Layer Count, 8 Layers: total, 180 Oranges.



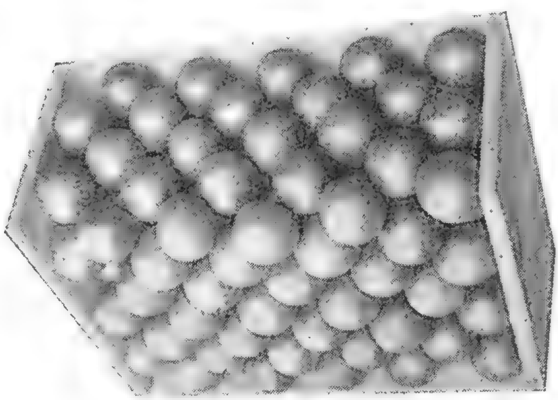
First Layer.

NOTE.—The same Layer Count (3-2, 5 x 4) is used when packing 158 Pack, which contains one layer less.

3-2 Pack, 5 x 5 Layer Count, 7 Layers: total, 175 Oranges.



First Layer.



Finished Case. 175 Count.

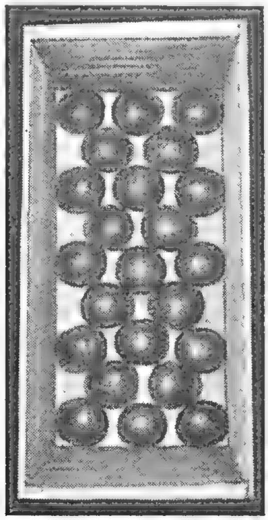
NOTE.—The same Layer Count (3-2, 5 x 5) is used when packing 200-pack, which contains 8 layers.

PLATE 52.

AUSTRALIAN DUMP CASE—*continued.*

Table B—*continued.*

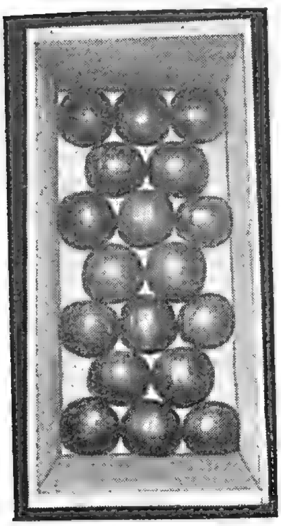
3-2 Pack, 5 x 4 Layer Count, 7 Layers, total, 158 Oranges.



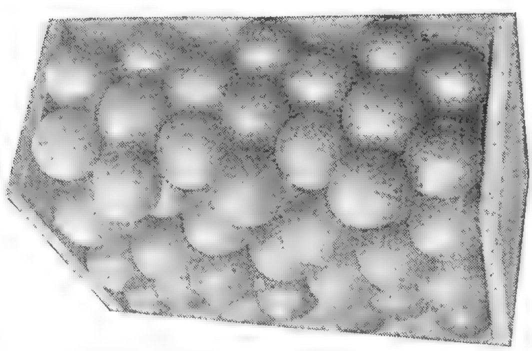
First Layer.

Note.—The same Layer Count (3-2, 5 x 4) is used when packing the 180 Pack, which contains one layer more.

3-2 Pack, 4 x 3 Layer Count, 6 Layers: total, 105 Oranges.



First Layer.



Finished Case.

Plate 53.

Table "D."

Intermediate Packs for the Standard Case.—Avoid using these packs as much as possible. Use them only for types of fruit that do not come to the correct height when the packs mentioned in Table "C" are used:—

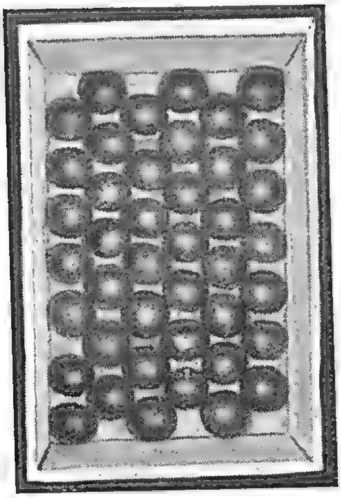
Approximate Size.	Pack.	Layer Count.	Number of Layers.	Total.
$2\frac{3}{4}$ inches	3-3	8-7	5	225
	3-3	7-7	5	210
	3-2	8-8	5	200
	3-3	7-6	5	195
$2\frac{1}{2}$ inches	3-2	8-7	5	188
	3-3	6-6	5	180
	3-3	6-5	5	165
	3-3	5-4	6	162
	3-3	5-5	5	150
$2\frac{3}{4}$ inches	3-3	5-4	5	135
	3-3	4-4	5	120
	3-2	6-6	4	120
3 inches	3-2	6-5	4	110
	3-2	5-4	4	90
	3-2	4-3	5	88

Bringing the Pack to the Correct Height in the Case.—Oranges packed in the Standard Case should be packed $1\frac{1}{2}$ to 2 inches above the top of the case, and be gently eased into position before applying the lid. This operation is done either by using a case press, or by placing blocks under the ends of the case and using a dumping lid, which is placed on the case and held in position whilst the ends of the case are gently bumped, the fruit settling gently into the pockets of each layer. When using the press or blocks for the process of dumping, care must be taken to see that the bottom of the case is kept clear of the floor or nailing-down stand, so that the bottom of the case can bulge when the nailing-down is complete. A good dumping lid is made by thinly padding a piece of wood the same size as the lid of the case with hessian or a similar substance. After nailing the Standard Case should have a bulge on the top and the bottom of from 1 inch to $1\frac{1}{2}$ inches. Remember tight or closed packs, such as count 175, should not be brought as high in the case as the open or loose packs, such as count 180.

Where lids and bottoms are cut too thick for them to bend easily when being placed on the case, it is better for the packer to reduce the height of the fruit in the case to avoid squeezing or pressure marks. The advantages of using the correct bulge can easily be offset by badly-milled case lids and bottoms causing damage.

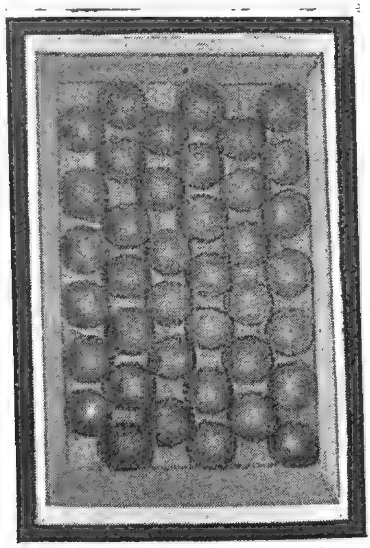
STANDARD CASE.

First Layer.
3-3 Pack.



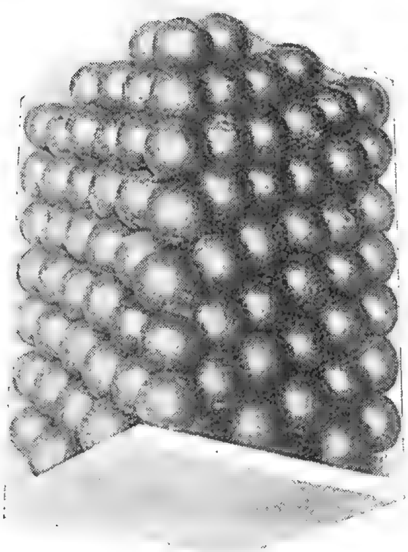
7 x 7 Layer Count, 6 Layers: total, 252.

First Layer.
3-3 Pack.



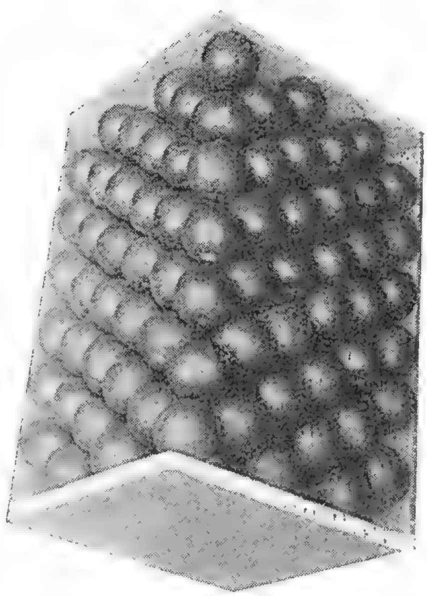
7 x 6 Layer Count, 6 Layers: total, 234.

Finished Case.



3-3 Pack, 252 Count.

Finished Case.



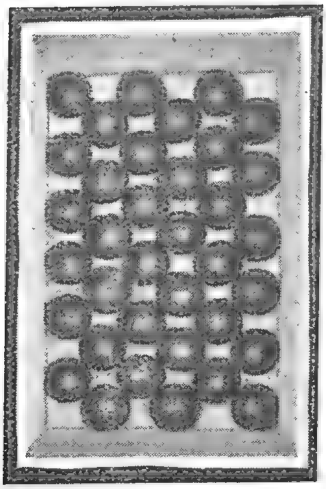
3-3 Pack, 234 Count.

Note the alignment of the fruit in the case.

PLATE 54.

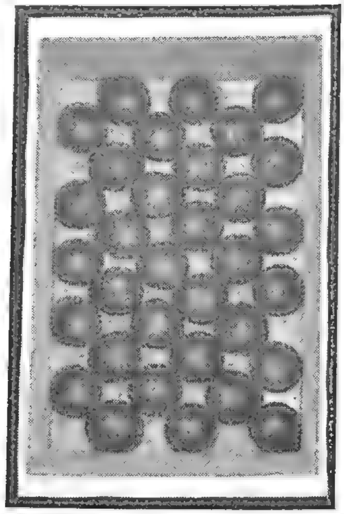
STANDARD CASE.

First Layer.
3-3 Pack.



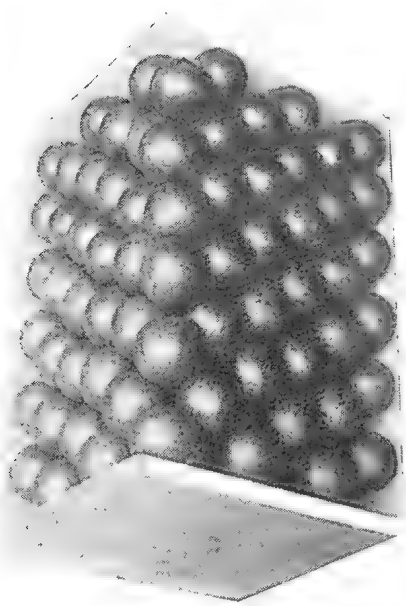
6 x 6 Layer Count, 6 Layers:
216 Count.

First Layer.
3-3 Pack.



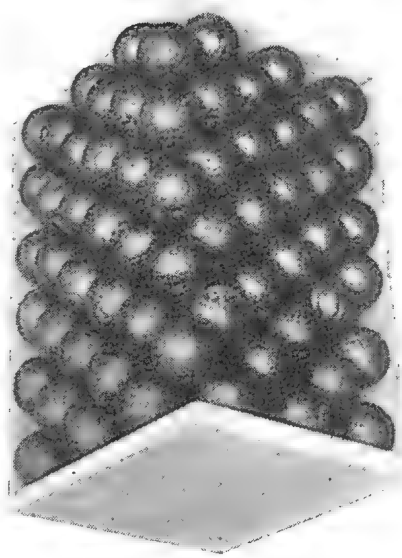
6 x 5 Layer Count, 6 Layers:
198 Count.

Finished Case.



3-3 Pack, 216 Count.

Finished Case.



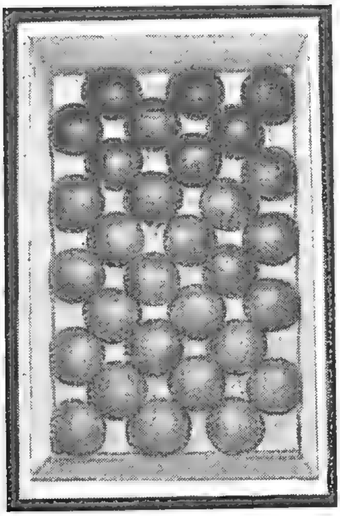
3-3 Pack, 198 Count.

Note the alignment of the fruit in the case.

PLATE 55.

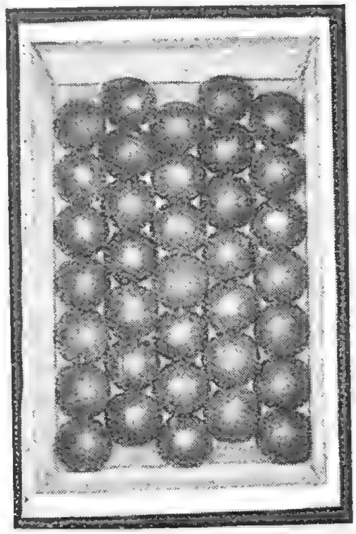
STANDARD CASE.

First Layer.
3-3 Pack.



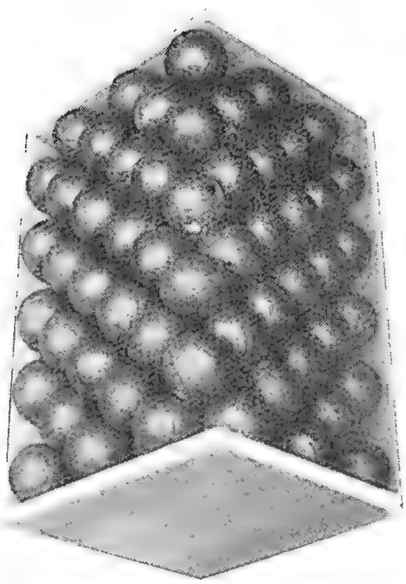
5 x 5 Layer Count, 6 Layers: total, 180.

First Layer.
3-2 Pack.



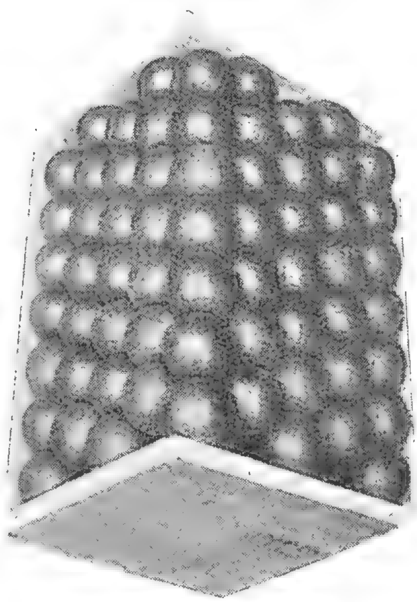
7 x 7 Layer Count, 5 Layers: total, 175.

Finished Case.



3-3 Pack, 180 Count.

Finished Case.



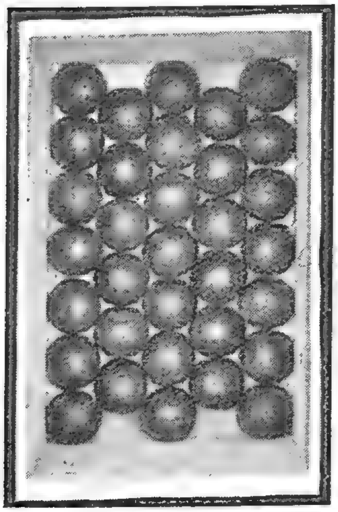
3-2 Pack, 175 Count.

Note the alignment of the fruit in the case.

PLATE 56.

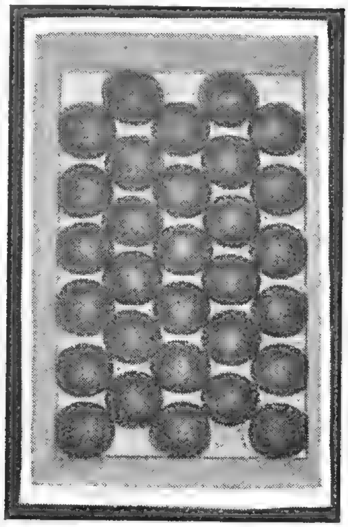
STANDARD CASE.

First Layer.
3-2 Pack.



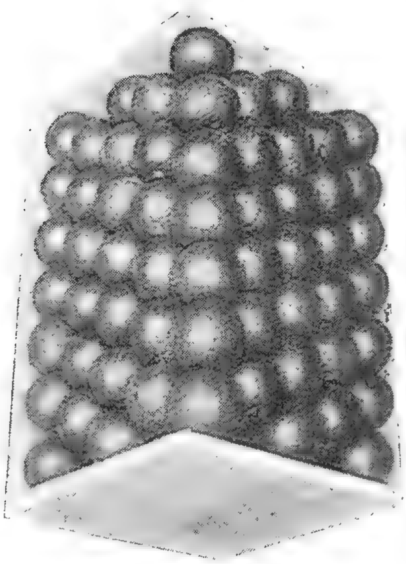
7 x 6 Layer Count, 5 Layers: total, 163.

First Layer.
3-2 Pack.



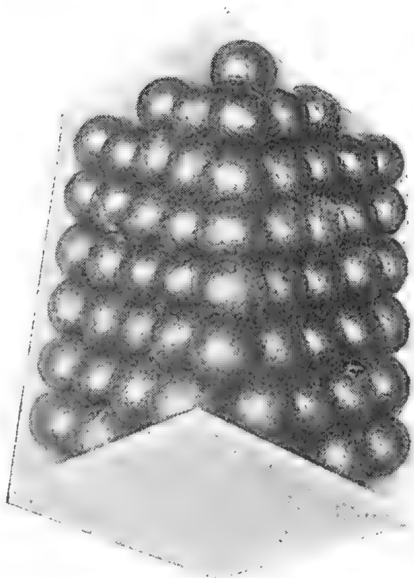
6 x 6 Layer Count, 5 Layers: total, 150.

Finished Case.



3-2 Pack, 163 Count.

Finished Case.



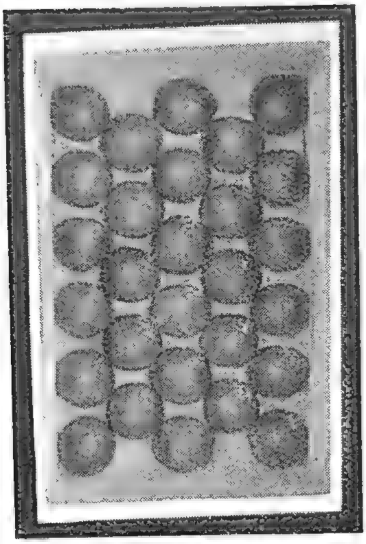
3-2 Pack, 150 Count.

Note the alignment of the fruit in the case.

PLATE 57.

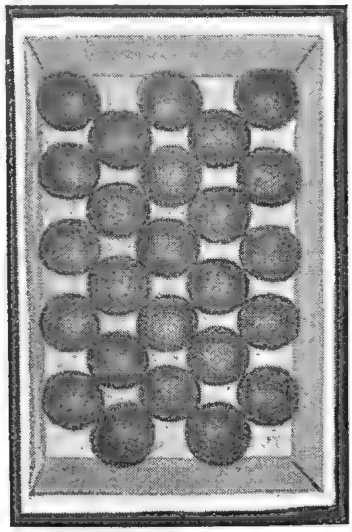
STANDARD CASE.

First Layer.
3-2 Pack.



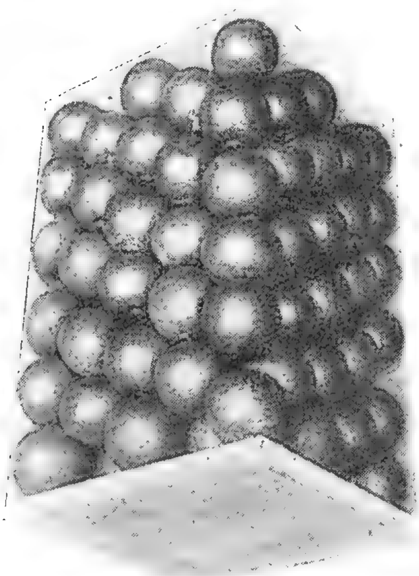
6 x 5 Layer Count, 5 Layers: total, 138.

First Layer.
3-2 Pack.



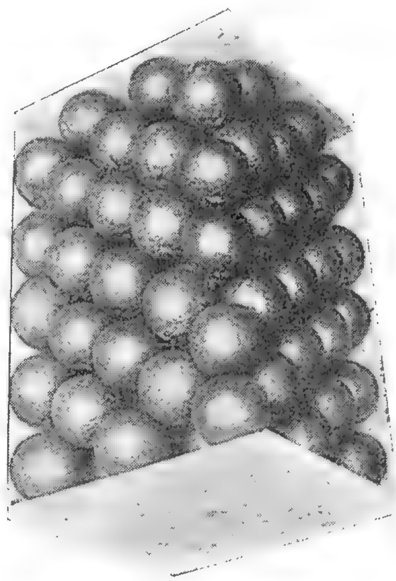
5 x 5 Layer Count, 5 Layers: total, 125.

Finished Case.



3-2 Pack, 138 Count.

Finished Case.



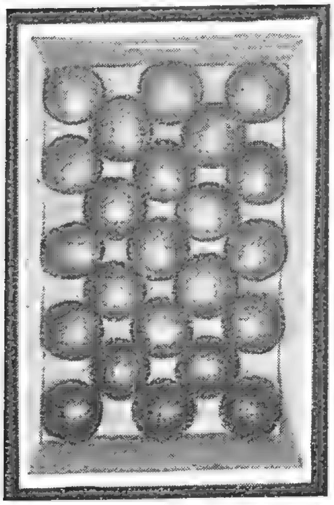
3-2 Pack, 125 Count.

Note the alignment of the fruit in the case.

PLATE 58.

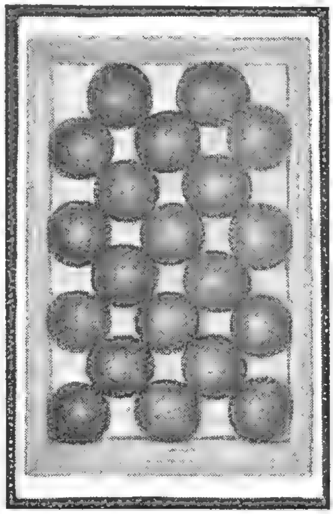
STANDARD CASE.

First Layer.
3-2 Pack.



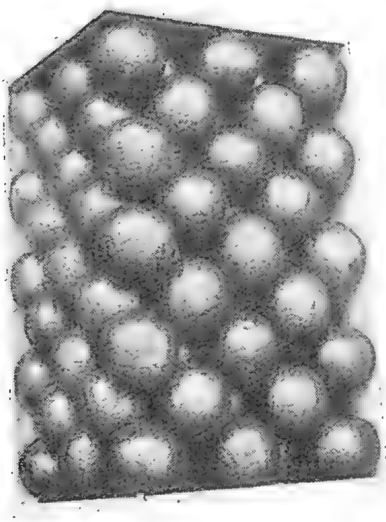
5 x 4 Layer Count, 5 Layers: total, 113.

First Layer.
3-2 Pack.



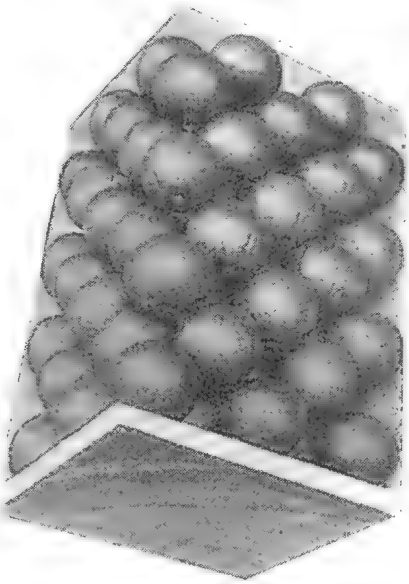
4 x 4 Layer Count, 5 Layers: total, 100.

Finished Case.



3-2 Pack, 113 Count.

Finished Case.



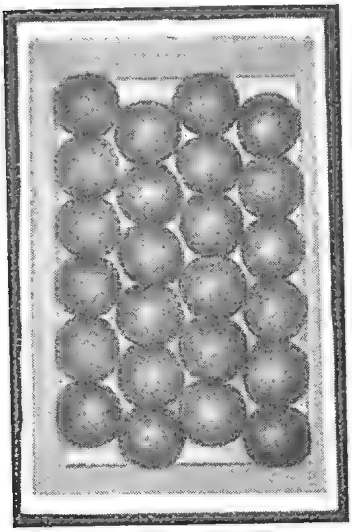
3-2 Pack, 100 Count.

Note the alignment of the fruit in the case.

PLATE 59.

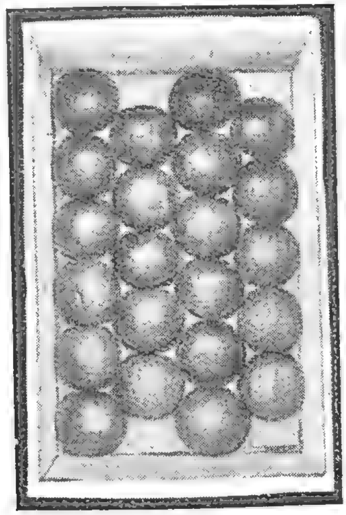
STANDARD CASE.

First Layer.
2-2 Pack.



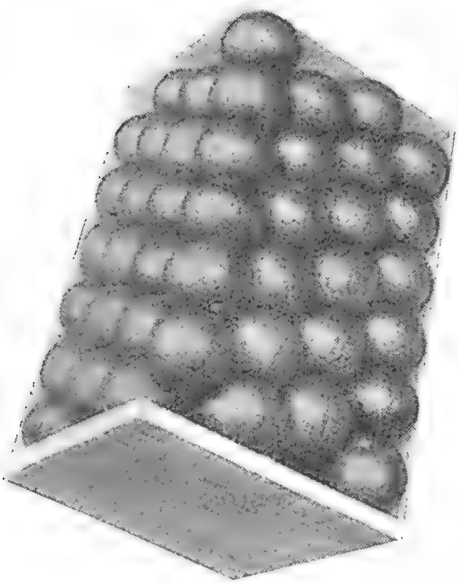
6 x 6 Layer, 4 Layers:
total, 96.

First Layer.
2-2 Pack.



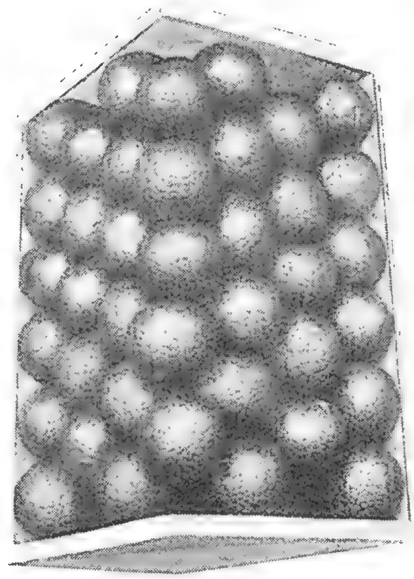
6 x 5 Layer, 4 Layers:
total, 88.

Finished Case.



2-2 Pack, 96 Count.

Finished Case.



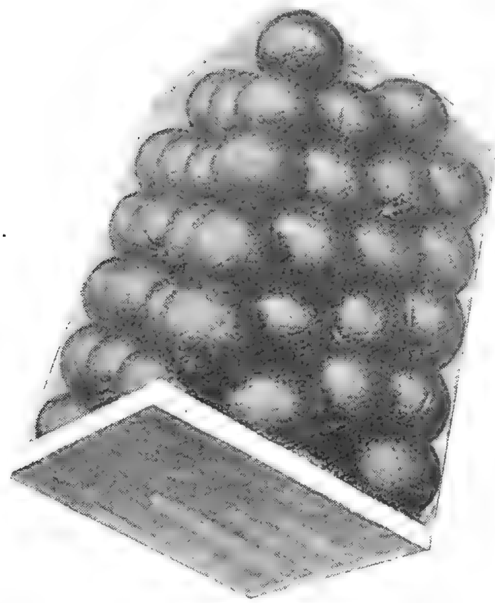
2-2 Pack, 88 Count.

Note the alignment of the fruit in the case.

Plate 60.

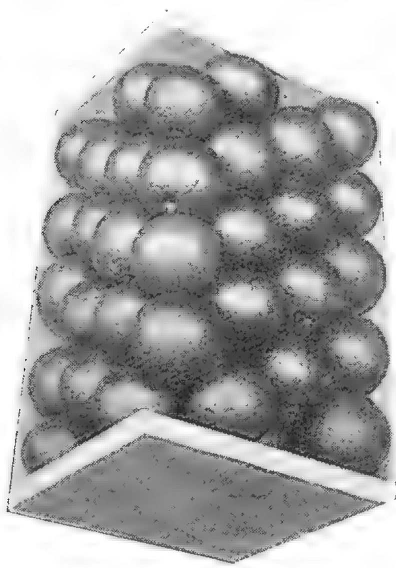
STANDARD CASE.

Finished Case.



2 2 Pack, 5 x 5 Layer. 4 Layers, 80 Count.

Finished Case.



2-2 Pack, 5 x 4 Layer. 4 Layers, 72 Count.

Note the alignment of the fruit in the case.

PLATE 61.

[TO BE CONTINUED.]

Casein as a Commercial Commodity.

THE manufacture of casein from skim milk and butter milk is an industry that has been carried on in other parts of the world for years. The importance of casein, particularly casein glue, was realised during the war, when it was used extensively in aeroplane construction, especially for plywood for fuselage coverings, and engine beds. Since the World War its manufacture has increased enormously owing to the increasing commercial application of this commodity.

It is difficult to keep pace with the march of casein into the commercial arena. It has entered the paper industry, where it is used for producing highly glossed surfaces on paper so essential for fine lithographic work. It is utilised extensively in glue preparations, supplanting many of the animal and other glues previously known. As a glue it is used in wood-working industries, such as motor-car body frames, pianos, furniture, doors, refrigerators, and numerous others.

In the realm of plastics its uses are increasing day by day, it being used as a substitute for horn, celluloid, bone, ivory, ebony, pearl, amber, and tortoise shell, and when we consider the vast number of beads, buttons, buckles, combs, cigarette holders, cuff links, electrical insulators, manicure and toilet sets, pen holders, fountain pen barrels, pencils, pipe stems, spectacle frames, &c., that are sold every day, some idea can be gleaned of the importance of casein in the plastic industry alone.

The articles already mentioned should suffice to establish its importance, but when we remember also that it is extensively used in such industries as paints, textiles, leathers, spreaders, and adhesives, foods, and medicine preparations, and such miscellaneous substances as face cream, pastes, shoe polish, insecticides, sprays, &c., so it is obvious that the possibilities of casein as a commercial commodity are enormous.

TO SUBSCRIBERS—IMPORTANT.

Several subscriptions have been received recently under cover of unsigned letters. Obviously, in the circumstances, it is impossible to send the Journal to the subscribers concerned.

It is most important that every subscriber's name and address should be written plainly, preferably in block letters, in order to avoid mistakes in addresses and delay in despatch.

Testing Acidity in Milk and Cream.

Material Required.

Decinormal caustic soda solution.

Phenol-phthalein solution (indicator).

(The above solutions should be prepared by a chemist.)

One pipette of 9, 10, or 17·6 c.c. or other stock size.

One white cup.

One 25 c.c. burette graduated to 0·1 c.c.

Distilled or rain water.

One glass stirring-rod.

Method of Making the Test.

1. First stir the cream or milk in order that a representative sample of the whole may be obtained.

2. Measure a sample of cream or milk into the cup. Rinse the pipette with distilled or rain water, and place the rinsings also in the cup.

3. Add three or four drops of indicator.

4. From the burette run the alkali solution into the mixture while constantly stirring it, and until it assumes a uniform faint pink tint. This is the end point of the test and all acid is neutralised.

Especial care should be taken at this point. If the colour does not disappear within thirty to sixty seconds after the completion of the test, too much alkali has been used, and an incorrect result will be obtained.

5. Note to 0·1 c.c. the quantity of alkali used.

Calculating the Result of the Test.

As 1 c.c. of the alkali solution exactly neutralises 0·009 grammes of lactic acid, the result may be obtained as follows:—

Multiply the number of c.c. of alkali used by 0·009, divide the result by the number of c.c. of the sample of cream or milk, and multiply this result by 100.

The method generally adopted in making this test in dairy factories in this State is similar to the above, but a 9 c.c. pipette is used, and the test result is read direct from the burette, each cubic c.c. of alkali used being calculated as 0·1 per cent. of acid; thus, if the amount of alkali used to neutralise 9 c.c. of milk or cream is 2·7 c.c., the acidity is 0·27 per cent.

This method is simple and quite satisfactory if care be taken to ensure accuracy in measuring the sample of milk or cream, the amount of alkali used, and in completing the test as indicated by the action of the colour changes abovementioned.

ACIDITY REDUCTION TABLE FOR CREAM.

Compiled by F. J. WATSON, Dairy Instructor.

Basis of Table:—·093 lb. soda bicarb. neutralises ·1 per cent. of acid in 100 lb. cream.

PERCENTAGE OF REDUCTION DESIRED.

BICARBONATE OF SODA REQUIRED IN POUNDS AND OUNCES.

..	·02	·04	·06	·08	·10	·12	·14	·16	·18	·20	·22	·24	·26	·28	·30	·32	·34	·36	·38	·40	·42	·44	..
lb. cream.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. cream.
50	0 0	0 0	0 0	0 0	0 0	0 1	0 1	0 1	0 1	0 1	0 2	0 2	0 2	0 2	0 2	0 2	0 2	0 3	0 3	0 3	0 3	0 3	50
100	0 0	0 0	0 1	0 1	0 1	0 2	0 2	0 2	0 3	0 3	0 3	0 4	0 4	0 4	0 4	0 5	0 5	0 5	0 6	0 6	0 6	0 7	100
200	0 0	0 1	0 2	0 2	0 3	0 4	0 4	0 5	0 6	0 6	0 7	0 7	0 8	0 8	0 9	0 10	0 10	0 11	0 11	0 12	0 12	0 13	200
300	0 1	0 2	0 3	0 4	0 4	0 5	0 6	0 7	0 8	0 9	0 10	0 11	0 12	0 13	0 13	0 14	0 15	1 0	1 1	1 2	1 3	1 4	300
400	0 1	0 2	0 4	0 5	0 6	0 7	0 8	0 10	0 11	0 12	0 13	0 14	0 15	1 1	1 2	1 3	1 4	1 5	1 7	1 8	1 9	1 10	400
500	0 1	0 3	0 4	0 6	0 7	0 9	0 10	0 12	0 13	0 15	1 0	1 2	1 3	1 5	1 6	1 8	1 9	1 11	1 12	1 14	1 15	2 1	500
600	0 2	0 4	0 5	0 7	0 9	0 11	0 12	0 14	1 0	1 2	1 4	1 5	1 7	1 9	1 11	1 13	1 14	2 0	2 2	2 4	2 5	2 7	600
700	0 2	0 4	0 6	0 8	0 10	0 12	0 15	1 1	1 3	1 5	1 7	1 9	1 11	1 13	1 15	2 1	2 3	2 5	2 8	2 10	2 12	2 14	700
800	0 2	0 5	0 7	0 9	0 12	0 14	1 1	1 3	1 5	1 8	1 10	1 13	1 15	2 1	2 4	2 6	2 8	2 11	2 13	3 0	3 2	3 4	800
900	0 3	0 5	0 8	0 11	0 13	1 0	1 3	1 5	1 8	1 11	1 13	2 0	2 3	2 5	2 8	2 11	2 14	3 0	3 3	3 6	3 8	3 11	900
1000	0 3	0 6	0 9	0 12	0 15	1 2	1 5	1 8	1 11	1 14	2 1	2 4	2 7	2 10	2 13	3 0	3 3	3 6	3 9	3 12	3 14	4 1	1000
2000	0 6	0 12	1 2	1 8	1 14	2 4	2 10	3 0	3 6	3 12	4 1	4 7	4 13	5 3	5 9	5 15	6 5	6 11	7 1	7 7	7 13	8 3	2000
3000	0 9	1 2	1 11	2 4	2 13	3 6	3 14	4 7	5 0	5 9	6 2	6 11	7 4	7 13	8 6	8 15	9 8	10 1	10 10	11 3	11 11	12 4	3000
4000	0 12	1 8	2 4	3 0	3 12	4 7	5 3	5 15	6 11	7 7	8 3	8 15	9 11	10 7	11 3	11 14	12 11	13 6	14 2	14 14	15 10	16 6	4000
5000	0 15	1 14	2 13	3 12	4 10	5 9	6 8	7 7	8 6	9 5	10 4	11 3	12 1	13 0	13 15	14 14	15 13	16 12	17 11	18 10	19 8	20 7	5000

The Velvet Bean.

By N. A. R. POLLOCK, H.D.A., Senior Instructor in Agriculture.

THE Podbearers, known as Velvet Beans, are grouped as species of the genus Stizolobium, syn. Mucuna, of the Natural Order Leguminosæ. They are recorded as natives of Tropical America, Asia, and Africa, with one from Fiji.[1]

As a farm crop the velvet bean is comparatively new, little attention having been devoted to it until within the last half-century. Prior to that the chief value of the genus was regarded as a source of the Cowhage or Cowitch of the materia medica, which was obtained from the species pruriens and prurita.

The name Velvet Bean is derived from the velvety feel and appearance of the pods, particularly those of the Florida species.

The genus comprises upward of twenty species, but only five have been deemed worthy of cultivation. These are the Lyon; Chinese; Yokohama, the pods of which are covered with short white or greyish hairs; Mauritius; and Florida, the pods of which are covered with short thick black velvety hairs.

There are at present a considerable number of varieties obtained by selection from species and their cross breeding. These vary in the colour of the flowers, length of pods, and colour of seeds, which may be white, brown, mottled, or black, as well as in their period of growth to maturity.

The best-known variety in Queensland is the Mauritius, which is largely grown in the canefields of the North for a green manure. This variety is probably of later-maturing habit than others, as it takes usually sixteen weeks to produce the first flowers and twenty-seven weeks to ripen the first pod. The seeds are shining black, rather flat, with a prominent white hilum, three to five being contained in a pod about 4 inches long.

The *Early Georgia,* a variety of the Florida species, is perhaps the earliest to mature, flowers forming in about eight weeks from germination of the seed and the first pods ripening in about nineteen weeks. The ripe pods are black, very hairy, 2 to 2½ inches long, and contain three or four seeds. The seeds, about the size of a marble, are oval or rounded, light in colour, with brownish black mottling.

The *Yokohama* is what may be termed of mid-season maturity, taking twelve weeks to flower and about twenty-two weeks to ripen the first pods. The pods are from 4 to 5 inches long, and contain usually five seeds of dull or greyish-white colour, flat, oblong, and often slightly depressed at the sides.

Early-maturing varieties are suggested in E. Georgia, Early Black, E. Arlington, Alabama, 100-day Speckled, &c.

Medium-maturing varieties are Yokohama, Lyon, and Chinese.

Late-maturing varieties are Mauritius and White Stingless.

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[1] Nicholson, Encyclopedia of Horticulture.

Climate.

The Velvet Bean being native of tropical latitudes can be expected to give the best return in the Northern parts of the State, but good yields may be expected during the summer in all parts when early-maturing varieties are sown and sufficient rain falls to provide the necessary soil moisture. Being of comparatively long-season growth the seed of any variety should be sown early and as soon after danger from frost is past as possible, especially in cooler parts.

Soils.

The Velvet Bean will succeed on a wide range of soils from a coarse sand to a heavy clay loam, provided they are sufficiently well drained. The best growth can naturally be expected on a free-working fertile loam. Low-lying soils that are apt to become water-logged are not suited to the crop, as owing to the dense foliage produced the free circulation of air is not permitted, and rotting is likely to result.

PLATE 62.
Early Georgia Velvet Beans, Tolga, ten weeks growth.

Uses.

Green Manure, being probably the most vigorous of all legumes cultivated, the volume of growth commends the Velvet Bean as a crop to be ploughed under as a green manure, to restore organic matter in the soil. In common with many other legumes, the nodules formed by the nitrogen-fixing bacteria are plentiful on the extensive root system, thus adding materially to its value in that respect.

Hay or Grazing.—The vines either green or cured as hay form a nutritious and palatable fodder for stock. In curing for hay the vines

must necessarily be cut by hand. Soon after the first flowers have formed is regarded as the best time, as the vines will then be less coarse. Shortly after wilting they should be put into cocks through which the air will readily circulate. As with other legumes the chief food value lies in the leaves, the retention of which is of major importance. In favourable weather, after the lapse of a few days the hay can be stacked, when, if the vines are not quite cured, a mild fermentation will perhaps render the vines more digestible or attractive as in brown lucerne hay. This fermentation, however, should not be sought, as it can go too far, and the aim should be to stack properly cured with a full retention of the leaves.

PLATE 63.
One Plant Early Georgie Velvet Bean, Tolga—ten weeks' growth.

Feeding-off.—The heavy yield of nutritious fodder renders the crop attractive for feeding-off, and excellent results, both in fattening and milk production, are reported from grazing cattle thereon. It also provides a profitable range for pigs. As the plants are of vigorous and long-continued growth, a daily period of grazing by dairy cows, with a final ploughing under as a green manure, should be profitable.

PLATE 64.
Velvet Beans, Toonpan, Townsville.

PLATE 65.
Velvet Beans growing amongst maize, Kairi, Atherton Tableland.

For Ensilage.—As an addition to maize or sorghum for ensilage, the Velvet Bean from its high protein content is of value. When grown conjointly the vines will climb the stalks, facilitating harvest. Grown in this manner also, the mixed crop has an added value when fed-off by pigs.

Seed.—The seeds form a valuable concentrate much relished by stock. Being usually as large or larger than a schoolboy's marble, farm animals can be expected to masticate them sufficiently for digestion. Crushing or grinding to a meal with or without the pod, which has some food value, however, is regarded as most economical. The green seeds, shelled as in the manner of Broad Beans or Lima Beans, are often esteemed for human consumption.

A heavier yield of seed is obtained when the plants are supported (see under "Cultivation.")

Cover Crop.—As a cover crop to keep down weeds, the heavy and long continued growth of the Velvet Bean commends it. When a field has become heavily weed-infested with growths hard to keep down or eradicate, the crop is of material advantage. It may be found of much value in this direction where the land is infested with Johnson grass.

Analyses.

From Henry and Morrison's "Feeds and Feeding," the following analyses are extracted to show the fodder value of the Velvet Bean:—

—	Total Dry Matter in 100 Lb.	Digestible Nutrients in 100 Lb.				Nutritive Ratio.
		Crude Protein.	Carbo-hydrate.	Fat.	Total.	
Seed	88·3	18·1	50·8	5·3	80·8	1 : 3·5
Seed and Pod	87·7	14·9	51·7	3·8	75·3	1 : 4
Hay	92·8	12·0	40·3	1·4	55·5	1 : 3·6
Green Material	17·9	2·7	7·2	0·4	10·8	1 : 3

Cultivation.

The land should be ploughed at least 6 inches in depth—cross-ploughed if necessary—and harrowed to produce a good tilth, as with other crops.

The seed is usually sown singly at intervals of 1 foot or 18 inches apart, in drills 4 to 5 feet apart. Sometimes the seed is sown in hills 3 feet apart; 10 to 20 lb. are regarded as sufficient for an acre. Inter-row cultivation should be practised to keep down weeds until the vines spread, probably over a period of four weeks, when the crop will need no further attention.

When sown as a mixture with maize or sorghum for grazing-off or for silage, the seed may be sown in the drill at the same time or after the maize or sorghum has germinated. In tropical parts, where the cereal makes a more rapid growth, it is perhaps preferable to sow the velvet bean seed, at the same time spacing the seeds 3 or more feet

apart in the drill. In cooler parts, it is advised to sow after the cereal has germinated at the time of its first cultivation or within three weeks.

Where the yield of seed is important or where it is to be saved separately from the hay, growth on tripods is recommended. These tripods can be formed of bush poles, say, 10 feet long, loosely wired about 2 feet from the top, so that two legs will rest on one drill and the third on the next. Tripods should alternately face reverse directions, and should be erected when the vines are growing towards the centre of the rows, after some cultivation has been given.

PLATE 66.
A Velvet Bean Crop in the Lower Burdekin District.

Grown on tripods, or in situations where the vines will be elevated, a very much greater yield of pods and seed will result. As much as double and treble such yield can be expected over plants running on the ground. Not only is the yield increased by growing on tripods, but the pods are much more easily harvested, since they will hang in bunches of as many as twenty or more, while those of prostrate growth will occur in much fewer numbers. Harvest of the vines, which have some value when the pods are removed, is facilitated when grown on the poles of the tripod, or they can be ploughed under when the poles are removed.

Yields.

The yield of vine growth will be determined by the soil and seasonal conditions and the period of growth, but 20 tons per acre of the green material in the case of the Mauritius variety is not unusual, and 10 tons or more per acre of the early-maturing sorts can be expected on reasonably fertile soil in a favourable season.

The yield of seed may be anything up to 30 bushels per acre with early-maturing varieties, or 50 bushels with medium and late maturing

kinds. When grown on tripods, however, the yield is much increased, and as many as 100 bushels per acre have been obtained in other countries.

The following yields were recorded in trials made some years ago in the Northern district:—

At Tolga—Early Georgia variety, 10 tons 18 cwt. per acre of green stuff when the first pods were setting.

At Millaa Millaa—Sown 2nd November, estimated 3rd March: Early Black, 18 tons per acre of green material; Early Georgia, 14 tons 9 cwt. per acre of green material; Mauritius, 11 tons 5 cwt. per acre of green material.

PLATE 67.
Velvet Beans, Lower Burdekin—a closer view of Plate 66.

Shelling the Seed.

While some of the varieties have thin pods, which readily break when dry to release the seed, others, such as the Mauritius, present thick hard shells, which are more difficult to treat.

Machinery to shell the seed is available, but in its absence it is advised to spread the pods exposed to the hot rays of the sun. When thoroughly dry a sprinkling with water from a hose or watering-can will cause the shells to shrink and burst open, thus releasing the seed.

For home use the whole pods can be ground, and the coarse part of the pods sifted out from the meal. Pigs have no trouble in shelling the pods, which should be fed to them whole.

Diseases.

The Velvet Beans appear to be remarkably free from disease, no instance of such having been recorded in the State, or as far as is known in other parts of the world.

Agricultural Notes.

By H. S. HUNTER, Agricultural Branch.

Crop Prospects.—The month of June yielded but little rainfall, and the consequential depreciation of the pastures, coupled with the cold weather, has been reflected in a falling-off in the output of dairy products. The paucity of the rainfall also has retarded the preparation of the land for fodder crops for early spring sowing. The decreased output on the dairy farms has been compensated for to some extent by improved values for commercial butter as a result of the operations of the Butter Stabilisation Scheme.

Sugar.—The past month was associated with cooler atmospheric conditions, and crop growth has been retarded in all areas as a consequence. The season is one in which a high degree of flowering is being experienced. This means that further growth will not be possible, and a continuance of moist conditions will be necessary to ensure the absence of over-maturity before harvesting.

PLATE 68.—ON THE ROAD TO ROSEWOOD.

From a point near Minden, overlooking the rich farming lands of Marburg. Red and cocoa-coloured soils, covered originally by dense vine jungle, are characteristic of the Rosewood district, one of the most productive provinces in the State. This country has emerged from untrodden jungle to its present intensity of agricultural development in the short span of a single generation of Queensland pioneers.

Early reports from those mills which have commenced crushing operations suggest that the cane is of high sugar content this year, and on the preliminary estimates there is every probability that the sugar tonnage which will be produced will fall little below that of 1933.

Wheat.—The lack of rain has been felt particularly in the farming districts beyond the Range. The precipitations which were received at the end of the month over a large portion of the wheatgrowing area were generally of a light nature and only sufficient to freshen up the growing crops. Except on areas which had received an early cultivation and

where good bottom moisture was present in the soil the fall on the whole was insufficient to permit of completing the main sowing.

In the Maranoa the dry spell has been of longer duration, practically no rain having fallen in May and, in addition, the district has been invaded by a plague of grasshoppers which has caused considerable damage to young seedling wheat. The greater part of the Maranoa wheat area, however, still remains unsown.

Canary Seed.—Other States of the Commonwealth, particularly South Australia and Western Australia, now are giving attention to the cultivation of canary seed, and as the market for this grain is limited Queensland growers have been warned of the dangers of overproduction. It has been estimated that States other than Queensland will harvest 500 tons of canary seed this year.

PLATE 69.—FERTILE FARMING LANDS IN SOUTHERN QUEENSLAND.
Looking towards Marburg from Minden.

Maize.—Harvesting of the late crop is now being carried out and, with the exception of some of the more inland districts where yields are light owing to dry conditions fairly good results are being obtained.

Large quantities are being held on the farms awaiting an improvement in the price.

Cotton.—The killing frosts commencing in mid-June have hastened the opening of the top bolls, thus allowing of the completion of the harvesting which is required in order to enable new crop preparations to start.

Owing to the completion of the first picking and the consequent lessening of pressure of receivals at the ginneries the Gladstone plant was closed on the 15th June. The Glenmore and Whinstanes plants are still operating busily with prospects of continuing for a couple of months, for a big top crop still remains to be harvested.

The ginnings to the 22nd June total 12,289 bales of lint, which is a record for the State, the individual ginnery outputs being: Glenmore, 6,130 bales; Gladstone, 2,170; and Whinstanes, 3,989.

Tobacco.—Harvesting now has been completed in areas subject to frost, and although in the frost-free districts of the North leaf is still being harvested, the cold weather has retarded the ripening of the leaf and, as a result, curing troubles are being experienced.

PLATE 70.—A HALT ON THE HIGHWAY TO THE DARLING DOWNS.
The country around Marburg, a district of comfortable homesteads, fertile fields, and agricultural abundance.

Tobacco growers are busily engaged in the grading of the leaf, uprooting and destruction of old plants to eliminate breeding grounds for pests and diseases, and in ploughing operations to permit of the land lying fallow until next planting season.

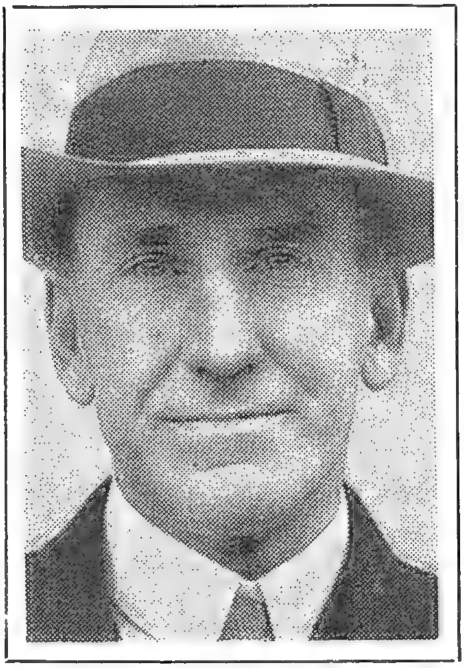
Melbourne Centenary Celebrations.—A display representative of Queensland's primary industries is to be staged in Melbourne for the Centenary Celebrations. The exhibit is to include wool, cotton, cereals, tobacco, and fruits. Tropical fruits such as pineapples, bananas, and pawpaws are to be featured, and an endeavour will be made to include plants bearing the different fruits.

The display is to be housed in the Melbourne offices of the Queensland Tourist Bureau.

LOSSES CAUSED BY SOIL EROSION.

The enormous economic losses caused by soil erosion in the United States of America are described by Mr. H. H. Bennett in "The Ohio Journal of Science." Mr. Bennett states that more than 100 million acres of the 350 million in cultivation in the United States have lost all or most of the precious material called top soil. At least 160 million acres of the remainder are suffering in some degree. To date, the essential destruction of about 35 million acres of what formerly was largely good crop land, together with an enormous additional area of grazing land, has been permitted. The land has been so deeply washed, so cut to pieces by gullying, or so smothered with the products of erosion that it cannot be reclaimed upon any practical basis by the average farmer. Much of it is permanently destroyed. Bedrock has been reached in countless places and deep gullies have torn asunder millions of sloping acres. All of this has been abandoned.

In Memoriam.



Mr. W. H. AUSTIN.

BY the death of Mr. W. H. Austin, Under Secretary of the Department of Labour and Industry, on 26th May, Queensland lost a distinguished public servant. No finer tribute could be paid to the memory of a public official than the statement of the Deputy Premier of the State that the late Mr. Austin exhausted himself in the conscientious discharge of duties.

The late Mr. Austin, who was 59 years of age, was one of the State's most valued servants, and his death came as a great shock to the Government and his friends. Mr. Austin was educated at the Normal School and later at the Brisbane Grammar School, of whose Old Boys' Association he was a past president. After a period with Messrs. Finney, Isles, and Co., Ltd., he entered the Government Savings Bank in 1892 and later was transferred to the Auditor-General's Department. In 1918 he became Deputy Auditor-General. At the end of that year he was appointed Commissioner of Trade in charge of State Enterprises, and subsequently combined these duties with that of Under Secretary of the Department of Labour and Industry. At the Labour Department Mr. Austin had a big task in dealing with the unemployment position. He personally interested himself in the many details associated with the settlement of unemployed families on group settlement schemes at Nerang, Mudgeeraba, Beerburrum, and in other areas on the North Coast. He was a most humane man in all his dealings with the unemployed and their difficulties.

Mr. Austin served on various important Commissions of Inquiry, notably that which sought information about the Beef Cattle Industry a few years ago. Recently he was a member of the Queensland Trade Delegation to the East. He was also a member of the Bureau of Industry. During the last two weeks preceding his death he put into operation the machinery for the distribution of winter relief to the unemployed and their families, and at the time of his death he was engaged in the preparation of a programme for the expenditure of loan money in reproductive and necessary works throughout the State, so as to provide employment.

He had a very fine personality, and he carried with him the unmistakable mark of the sportsman and athlete. Such attributes should have preserved him for many more years of usefulness for the State, but he was quite unsparing of his physical reserves and has passed away at an age when his experience and judgment were at their maturity.

In his earlier days he was one of the finest Rugby Union footballers in Queensland. He played with the City and South Brisbane teams, and represented Queensland against New South Wales in 1895, 1896, 1898, 1899, 1901, against New Zealand in 1896 and 1897, and against Great Britain in 1899. He was captain of the Queensland team in 1898. He also played cricket in his youth, and in 1894 he captained a Queensland junior cricket team against the mother State. In later years he was a prominent bowler.

Mr. Austin is survived by his widow and four sons. They are Messrs. W. T. (Sydney), A. J., C. G., and J. D. Austin, to whom deepest sympathy is extended.

TRIBUTES.

The Acting Premier (Hon. P. Pease) said he was satisfied that work and worry over the relief of unemployment contributed to Mr. Austin's untimely death. Mr. Pease paid a tribute to the great work accomplished by Mr. Austin and to his splendid character.

The Minister for Labour and Industry (Hon. M. P. Hynes) said that Mr. Austin's sympathetic handling of relief matters won for him a host of friends among the unemployed. Mr. Austin's death left a great gap in the Public Service which would be hard to fill.

The Leader of the Opposition (Hon. A. E. Moore) said that Mr. Austin was one of those super-conscientious men who spent his whole energies in his work. Mr. Austin really tried to do too much. He was one of the finest senior officers in the Public Service.

Mr. S. Winders (Mayor of Coolangatta), referring to Mr. Austin's death, said that the local authorities throughout Queensland working on the intermittent relief labour scheme had lost an invaluable adviser, whose co-operation in relieving unemployment would be sadly missed. The relief workers throughout the State owed a debt of gratitude to Mr. Austin, whose sympathetic handling of the difficult problems had assisted materially in alleviating distress and placing men in work.

A kindly and courteous public officer, he had rendered outstanding service to the State and to the local government bodies.

The Nerang Shire Council has been advised by the Department of Public Instruction that the new State school at the Mudgeeraba Banana Settlement has been named Austinville after the late Mr. Austin, who was mainly responsible for the control of the intermittent labour section of the department's activities.

The late Mr. Austin was laid to rest in the Toowong Cemetery on Monday, 28th May, in the presence of a vast gathering representative of the Government, Parliament, Public Service, Commerce, Industry, and numerous sporting organisations.

Land for Grazing Selection.

ELDERSLIE RESUMPTION.

A SUBDIVISION of Elderslie Resumption, situated about 28 miles westerly from Winton, will be opened for grazing homestead selection at the Land Office, Winton, on Tuesday, 21st August. The area of the block is 25,400 acres. The land will be opened for a term of lease of twenty-eight years at an annual rental of 1¾d. per acre for the first seven years of the term.

The whole area is very open to lightly-shaded downs with small patches of stony hills. It is artificially watered by an artesian bore fitted with a pumping plant and mill, and by a sub-artesian bore fully equipped with a pumping plant. These supplies are sufficient.

Other improvements include boundary netting and wire fencing and intersecting wire fencing, paddocks, huts, shed, yards, spraying race, &c., valued provisionally at about £3,000.

The selection will require to be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years, and proof must be furnished of the financial standing and pastoral or land experience of the applicants.

The existing marsupial netting fencing will require to be maintained marsupial-proof throughout the term of lease.

Free lithographs and full particulars may be obtained from the Land Agents, Longreach and Winton; the Land Settlement Inquiry Office, Brisbane; and the Government Intelligence and Tourist Bureaux, Sydney and Melbourne.

PLATE 71.
Lake Manchester, near Brisbane, Queensland.

PLATE 72.—BRISBANE GRAMMAR SCHOOL GROUP.

On the occasion of an instructional visit of the boys to the Laboratories of the Department of Agriculture and Stock on 25th May, under the guidance of Mr. Dakin (seated in the centre), of the B.G.S. Teaching Staff.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Guernsey Cattle Society, production charts for which were compiled for the month of May, 1934 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORN.			
	MATURE COW (OVER 5 YEARS), STANDARD 350 LB.			
Evelyn of Sunnyview	J. Phillips, Wondai	22,575·07	904·236	Diamond of Greyleigh
Princess V. of Cascade	C. O'Sullivan, Greenmount	12,897	463·449	Royal Rupert of Cascade
Pearl 6th of Quarnlea	Lehfeldt Brothers, Kalapa	12,932·78	454·16	Colonel of Blacklands
Rosebud of Happy Valley	R. R. Radel, Coalstoun Lakes	8,611·6	365·714	Mollys Hero of Glenthorn
Eva 12th of Quarnlea (261 days)	Lehfeldt Brothers, Kalapa	10,779·39	360·279	Fairplay of Burradale
Violet of Happy Valley	R. R. Radel, Coalstoun Lakes	8,088	357·104	Chief of Hillview
	SENIOR, 4 YEARS OLD, STANDARD 330 LB.			
Primrose 8th of Quarnlea	Lehfeldt Brothers, Kalapa	9,431·7	343·323	Nuggets Lad of Hillview
Happy Valley Belles Molly	R. R. Radel, Coalstoun Lakes	7,734·9	332·812	Mollys Hero of Glenthorn
Villa Maria Reddy 6th	J. Buckley, Ross Hill	7,565·5	332·528	Villa Maria Sarsfield
	JUNIOR, 4 YEARS OLD, STANDARD 310 LB.			
Pearl 17th of Quarnlea	Lehfeldt Brothers, Kalapa	8,752·48	385·177	Nuggets Lad of Hillview
Victory of Cedar Grove	A. C. Stewart, Coondoo	6,425·8	331·587	Mabel 2nd Victor of Coral Grange
Mountain Home Gem 6th	N. C. Lester, Laidley Creek West	8,295·56	328·172	Headlight of Greyleigh
	SENIOR, 3 YEARS OLD, STANDARD 290 LB.			
Ashdale Daisy	A. Frank, Boonah	12,324·3	541·895	Diamond of Greyleigh
	JUNIOR, 3 YEARS OLD, STANDARD 270 LB.			
Morden Sparkle	R. Mears, Toogoolwaah	12,671·05	541·266	George of Nestles
Miss Vesta II. of Blacklands	S. L. Holmes, Goomburra	7,880·5	308·126	Red Prince of Blacklands
Tottie 13th of Yaralla	P. Embrey, Rosewood	6,392	300·424	Southern Cross of Raleigh

SENIOR, 2 YEARS OLD, STANDARD 250 LB.				
Lynthorne Betty (268 days)	G. A. Meyers, Imbil	9,257·45	419·252	Plumstone of Blacklands
Lynthorne Peggy	G. A. Meyers, Imbil	8,362·15	365·437	Plumstone of Blacklands
Lynthorne Ida	G. A. Meyers, Imbil	8,999·25	361·757	Plumstone of Blacklands
Eva's Pride of Quarnlea (262 days)	Lehfeldt Brothers, Kalapa	8,697·23	323·47	Nuggets Lad of Hillview
Lynfield Success V.	V. Dunstan, Wolvi	7,651·55	309·811	Lavenders Pride of Blacklands
Lady Sal XIII. of Cedar Grove	A. C. Stewart, Coondoo	7,040·95	301·669	Duke of Cedar Grove
Navillus Mavis	C. O'Sullivan, Greenmount	6,904·75	285·403	Midgets Sheik of Westbrook
Glen Sally	A. C. Stewart, Coondoo	6,518·05	266·772	Lorna's General of Arley
JUNIOR, 2 YEARS OLD, STANDARD 230 LB.				
Star 2nd of Alfa Vale	W. H. Thompson, Nanango	10,922·95	436·685	Reward of Fairfield
Mabreen Tottie	V. Dunstan, Wolvi	9,308·25	357·182	Numbawarra Headlight
Rhodesview Nancy 8th	D. Gierkie and Sons, Helidon	8,631·25	347·229	Blacklands Prospector
Broady 7th of Villa Maria	S. L. Holmes, Goomburra	7,741·82	333·231	Greymare Gay Lad
Laguna Venus	F. G. Lamkin, Kaimkillenbun	7,982·86	320·773	Fuchsias Monarch of Rosenthal
Cedargrove Gusty 2nd	P. D. Fiechtner, Greenmount	7,140·15	307·489	Duke of Cedar Grove
Cedargrove Lady Prim 11th	P. D. Fiechtner, Greenmount	7,486·93	306·027	Duke of Cedar Grove
Rosenthal Lilac 4th	S. Mitchell, Warwick	6,765·75	292·227	Vain Prince
Navillus Olive 3rd	C. O'Sullivan, Greenmount	7,099·92	283·383	Midgets Sheik of Westbrook
Ashdace Lady Diana	A. Frank, Boonah	8,305·65	282·08	Red Knight of Kelston
Cedargrove Reddy 6th	P. D. Feichtner, Greenmount	6,409·88	281·412	Duke of Cedargrove
Cedargrove Iris	P. D. Feichtner, Greenmount	6,778·08	279·749	Duke of Cedargrove
Cedargrove Venus 6th	P. D. Feichtner, Greenmount	6,899·96	274·872	Duke of Cedargrove
Cedargrove Reddy 7th	P. D. Feichtner, Greenmount	6,443·6	268·164	Duke of Cedargrove
Daisy of Lynfield	F. E. Birt, Sexton	6,969·9	263·013	Lavenders Pride of Blacklands
Cedargrove Rosina II.	P. D. Feichtner, Greenmount	6,274·62	260·676	Duke of Cedargrove
Molly Belle of Happy Valley	R. R. Radel, Coalstoun Lakes	5,830·35	254·134	Venture of Happy Valley
Jubilee B of Rosenthal	F. G. Lamkin, Kaimkillenbun	5,798·64	253·82	Rosenthal Handsome Boy
Primrose VII. of Glenthorn	S. L. Holmes, Goomburra	6,683·24	246·479	Shamrocks Triumph of Burradale
Happy Valley Annie 5th	R. R. Radel, Coalstoun Lakes	5,313·55	240·691	Venture of Happy Valley

Production Recording—*continued.*

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
	JERSEY.			
	MATURE COW (OVER 5 YEARS), STANDARD 350 LB.			
Trecarne Rosella	T. A. Petherick, Lockyer	9,613·32	601·243	Trinity Officer
Pineview Lucy	J. Hunter and Sons, Borallon	10,175·55	576·135	Carnation Lad
Trecarne Empress II.	R. A. Slaughter, Clifton	7,066·4	365·971	Carnation Royal Scot
Seycombe Gladness	C. Seymour, Coalstoun Lakes	5,874·4	356·569	Carnation Royal
	SENIOR, 4 YEARS OLD, STANDARD 330 LB.			
Pineview Model	J. Hunter and Sons, Borallon	9,951·3	620·592	Pineview Noble Lad
Ruth of Ipsley (365 days)	J. A. Rudd, Yeerongpilly	9,163·66	539·304	Rhuban of Ipsley
Oxford Graceful	F. Nimmo, Rosewood	7,088	388·546	Trinity Ambassador
	SENIOR, 3 YEARS, STANDARD 310 LB.			
Lavender of Calton	J. Collins, Tingoora	12,105·97	605·795	Prince Clare of Calton
	JUNIOR, 3 YEARS, STANDARD 270 LB.			
Pineview Noble Buttercup	J. Hunter and Sons, Borallon	7,454·04	449·223	Oxford Buttercups Noble
Trecarne Coronation	D. R. Hutton, Cunningham	7,178·6	410·87	Trecarne Golden King
Eldon Lavender	J. B. Keys, Gowrie Little Plains	7,408·78	384·373	Retford Raleighs Chief
Glenview Springfield	F. P. Fowler and Sons, Coalstoun Lakes	5,818·5	336·13	Carlyle Larkspur 2nd Empire
Creamys Lady of Inverlaw	R. J. Crawford, Inverlaw	5,304·05	303·965	Bruce of Inverlaw
	SENIOR, 2 YEARS, STANDARD 250 LB.			
Oxford Astor Daisy	E. Burton and Sons, Wanora	7,568·83	510·208	Trinity Ambassador
Ripple of Ipsley	J. A. Rudd, Yeerongpilly	4,759·24	296·699	Ray of Ipsley
Seycombe Granny	C. Seymour, Coalstoun Lakes	3,994·75	250·918	Carnation Prince Charles
Overlook Remus Fawn	E. Burton and Sons, Wanora	6,995·25	400·055	Overlook Favourite Remus
Oxford Queen Daffodil	E. Burton and Sons, Wanora	6,224·55	374·495	Trinity Ambassador

College Fleur	Queensland Agricultural High School and College, Gatton	6,069·22	369·245	Burnside Defender
Trecarne Jersey Queen	T. A. Petherick, Lockyer	5,685·54	329·395	Trecarne Golden King
Pineview Lexie	J. Hunter and Sons, Borallon	5,461·85	314·203	Oxford Buttercups Noble
College Mildred	Queensland Agricuturlal High School and College, Gatton	5,691·18	305·956	Burnside Renown
Newhills Sirus	J. Nicol Robinson, Maleny	4,656·75	303·405	President of Brooklodge
Irene's Joyce of Wattle View	E. C. Groves, Kandanga	4,470·1	284·243	Prince Royal of Wattle View
Bellgarth Birthday	D. R. Hutton, Cunningham	5,270·5	279·963	Bellefaire, Blondes Bellringer
Glenview Hazel	F. P. Fowler and Sons, Coalstoun Lakes	4,611·05	277·535	Trinity Officer
Trecarne Rosella 6th	T. A. Petherick, Lockyer	4,489·57	261·448	Trecarne Golden King
College Dina	Queensland Agricultural High School and College, Gatton	4,672·17	260·300	Burnside Renown
Bellgarth Dawn	D. R. Hutton, Cunningham	5,212·5	252·322	Bellfaire Blondes Bellringer
Trecarne Sweetheart	T. A. Petherick, Lockyer	4,220·06	238·995	Trecarne Renown

GUERNSEY.

SENIOR, 2 YEARS OLD, STANDARD 250 LB.

Linwood Betsy	A. S. Cooke, Maleny	5,508·6	285·232	Caramana Barrister
East Glyn Ballet Girl	A. S. Cooke, Maleny	4,510·7	250·327	Caramana Prince
Laureldale Beatrix	W. A. Cooke, Maleny	5,250·5	248·784	Moonji Naughty Boy

AGRICULTURE ON THE AIR.

Radio Lectures on Rural Subjects.

Arrangements have been completed with the Australian Broadcasting Commission for the regular delivery of further radio lectures from Station 4QG, Brisbane, by officers of the Department of Agriculture and Stock.

On Tuesdays and Thursdays of each week, as from the 3rd July, 1934, a fifteen minutes' talk, commencing at 7.15 p.m., will be given on subjects of especial interest to farmers.

Following is the list of lectures for July, August, and September, 1934:—

SCHEDULE OF LECTURES.

BY OFFICERS OF THE DEPARTMENT OF AGRICULTURE AND STOCK, RADIO STATION 4QG, BRISBANE (AUSTRALIAN BROADCASTING COMMISSION).

Tuesday, 10th July, 1934—"Preparing Pigs for Show." By L. A. Downey, Instructor in Pig Raising.

Thursday, 12th July, 1934—"The Principles and Practice of Pig Feeding. By L. A. Downey, Instructor in Pig Raising.

Tuesday, 17th July, 1934—"Plants Poisonous to Stock." By C. T. White, Government Botanist.

Thursday, 19th July, 1934—"Plants Poisonous to Stock." By C. T. White, Government Botanist.

Tuesday, 24th July, 1934—"A Ramble in Rural England and its Lessons." By J. F. F. Reid, Editor of Publications.

Thursday, 26th July, 1934—"An Excursion to Scotland—Livestock Studies." By J. F. F. Reid, Editor of Publications.

Tuesday, 31st July, 1934—"Queensland—A Fruitful Country." By J. F. F. Reid, Editor of Publications.

Thursday, 2nd August, 1934—"The Story of Butter and Cheese throughout the Ages." By O. St. J. Kent, B.Sc., Analyst.

Tuesday, 7th August, 1934—"The Packing and Preparation of Tomatoes for Market." By J. H. Gregory, Packing Instructor.

Thursday, 9th August, 1934—"The Avocado in Queensland and Elsewhere." By H. Barnes, Director of Fruit Culture.

Tuesday, 14th August, 1934—"Packing Shed Hygiene." By J. H. Gregory, Packing Instructor.

Thursday, 16th August, 1934—"The Importance of Citrus Bud Selection." By H. Barnes, Director of Fruit Culture.

Tuesday, 21st August, 1934—"Papaw Cultivation." By H. Barnes, Director of Fruit Culture.

Thursday, 23rd August, 1934—"The Pasteurisation of Milk and its Products." By O. St. J. Kent, B.Sc., Analyst.

Tuesday, 28th August, 1934—"Vitamins in Dairy Products." By O. St. J. Kent, B.Sc., Analyst.

Thursday, 30th August, 1934—"Factors Influencing the Amount of Fat in Milk." By O. St. J. Kent, B.Sc., Analyst.

Tuesday, 4th September, 1934—"Seasonal Farm Crops," Part I. By C. J. McKeon, Instructor in Agriculture.

Thursday, 6th September, 1934—"Seasonal Farm Crops," Part II. By C. J. McKeon, Instructor in Agriculture.

Tuesday, 11th September, 1934—"Seasonal Farm Crops," Part III. By C. J. McKeon, Instructor in Agriculture.

Thursday, 13th September, 1934—"The Tobacco Industry Protection Act of 1933." By H. S. Hunter.

Tuesday, 18th September, 1934—"Some Requirements of Plant Growth." By E. H. Gurney, Agricultural Chemist.

Thursday, 20th September, 1934—"Fertilizers and Manures." By E. H. Gurney, Agricultural Chemist.

Tuesday, 25th September, 1934—"Nutritive Value of Pasture." By E. H. Gurney, Agricultural Chemist.

Thursday, 27th September, 1934—"Mineral Ingredients in Stock Foods." By E. H. Gurney, Agricultural Chemist.

Answers to Correspondents.

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. Cyril T. White, F.L.S.

Red Natal Grass.

E.A.T. (Stanthorpe)—

The specimen is *Rhynchylcytrum roseum* (Red Natal Grass). This grass is very common in many parts of Queensland, particularly in the coastal belt, where it is very abundant along railway cuttings, in pineapple and banana plantations, and, in fact, anywhere where the ground has been disturbed. It is not a particularly valuable grass for grazing, but is much used mixed with more palatable fodder as a chop-chop for working horses. It has a very light hold of the ground, and is eeasily pulled up by stock.

Berrigan.

M.M.K. (Springsure)—

The specimen is the Berrigan (*Eremophila longifolia*), a small tree or shrub, a native of Western Queensland and New South Wales. It should make an excellent garden shrub for dry places as it seems to stand dry weather remarkably well. The plant is quite a good fodder, and chemical analysis shows its nutritive value to be fairly high. In rabbit-infested areas it is said to be very hard to grow the shrub owing to the ravages of rabbits, which are exceedingly fond of the bark of this tree. Mr. Fred Turner, the well-known authority on grasses and fodder plants, in one of his books says that in certain parts of New South Wales large numbers of shrubs have been destroyed by rabbits eating the bark a few feet up the stems from the base. We were very interested to learn that the plant had transplanted so well, as it has generally been regarded as somewhat difficult to transplant. We are very keen on seeing the native trees and shrubs used more extensively for private and garden planting.

"Wild Lucerne."

J.W.H. (Caboolture)—

This plant first made its appearance in North Queensland a little over twenty years ago, but is reported to have been in the Northern Territory before that. It is now very abundant both in many parts of Queensland and the Northern Territory. Its botanical name is *Stylosanthes sundaica*, although it has previously gone under various names in Queensland—e.g., *Stylosanthes mucronata* and *Stylosanthes procumbens*. We think there is little doubt that where it has been introduced it has definitely increased the carrying capacity of the land. Its only drawback is that it is an annual. It generally germinates with the early summer rains, and is in full growth in January and February, but as far as we have observed stock do not care for it in its very green and luscious state, eating it very readily when it is drying off somewhat. This is rather a valuable feature, as the plant is dying off in the late summer and early autumn when other food is rather scarce. Experienced stockowners have told us that all classes of stock will lick up broken pieces of the dried plant in somewhat the same way as the Flinders Grasses. Chemical analysis carried out at the Agricultural Chemist's laboratory, Brisbane, shows the plant to approximate ordinary lucerne in nutritive value. As far as Australia is concerned, the plant was first recorded from the neighbourhood of Townsville, where it was looked upon as a weed of lawns, and hence is frequently known as Townsville Lucerne. It has been thought by some people that it may injure the native grasses by dying out and leaving bare patches, but as far as our experience goes this plant and the grasses seem to grow quite well together.

Emu Grass ("Dalby Wild Lucerne").

R.S. (Dalby)—

The specimen of "Dalby Wild Lucerne" has been determined as *Psoralea tenax*. This is a leguminous plant and is sometimes called Emu Grass. It is a native plant with a good reputation for fodder value.

Night Shade.

G.R.I.A. (Gympie)—

The specimen from Kilkivan has been identified as the Garden Night Shade (*Solanum nigrum*). It is widely spread over the warmer temperate regions of the world, and is a very common farm and garden weed in Queensland. The ripe berries are eaten by children, often in quite large quantities, without any ill effects. They are also commonly cooked for pies under the familiar name of blackberries, although, of course, they are quite distinct from the true blackberries of Europe and North America. The berries when green, however, are decidedly poisonous, and this applies, no doubt, to the other green parts of the plant. On this account the plant should be destroyed. Cases of poisoning in live stock are rare, and we were surprised to learn that the cattle had been eating it, for on the whole it is a plant rather rejected by them. The symptoms given are stupefaction, staggering, loss of feeling of consciousness, cramps, and sometimes convulsions. As in respect of many other plants of the Solanum family, or *Solanaceæ*, the pupils of the eyes of affected animals are generally dilated. The poisonous principle is an alkaloid Solanine. The eradication of the plant is recommended.

Groundsel Bush.

J.R. (Yeerongpilly)—

The specimen from Gympie has been determined as *Baccharis halimifolia*, the Groundsel Bush, a native of South America, and now a very common naturalised weed in Queensland. It has overrun many farms on the North Coast line, particularly towards the coast, on land that is sometimes subject to inundation. It is, however, not confined to such places, for we have had specimens from scrub farms on the Blackall and D'Aguilar Ranges. It is sometimes called Arsenic Bush, a name applied rather indiscriminately to some plants in Queensland, and this name does not seem justified. As some members of the genus have been suspected of poisoning stock in South America, feeding tests were carried out with this plant at Yeerongpilly some years ago, and after ten days to a fortnight's feeding the heifers were very thin and emaciated, but recovered when put back on to ordinary food. We should certainly say these heifers ate more of the plant than they would under natural conditions. From this it would seem that the plant has no fodder value, but is not poisonous. Some farmers on swampy coastal country in the neighbourhood of Noosa have told us that stock will browse on the plant, especially in drought time, and they have not noticed any ill effects from it.

A Common Weed (*Phaseolus lathyroides*).

H.R.H. (Giru)—

The specimen is *Phaseolus lathyroides*, a native of tropical America, now a common naturalised weed in Queensland. Although fairly abundant, we have not heard a common name applied to it. It was introduced many years ago as a fodder, but on the whole our experience has been that stock do not take readily to it, at least when other feed is available, although on occasions we have had specimens with the report that stock were eating it freely enough. Although introduced so long ago it is only during the last two or three years that the plant seems to have spread very much outside south-eastern Queensland, and now it seems to be throughout the coastal belt. It is a common tropical plant, widely spread over the tropical and sub-tropical countries of the world, and is not known to be poisonous or harmful in any way. We think if plant poisoning is your trouble the cause must be looked for elsewhere.

Pigweed.

INQUIRER (Townsville)—

The plant is *Portulaca filifolia*, a species of Pigweed, a native of North Queensland and the Northern Territory. The plant seems particularly prevalent this year, as we have had several specimens forwarded for identification from the North-west and Central-west. Like other members of the Pigweed family, it is not known to possess any harmful or poisonous properties, but if eaten by stock in any quantity on an empty stomach would cause "hoven" or "bloat."

"Cape Cotton."

T.M. (Dayboro')—

It is rather difficult to correctly name plants from descriptions only The usual practice is to forward small pieces a few inches long bearing either flowers or seed, and when more than one specimen is sent each should be labelled and duplicates retained, when names corresponding to numbers will be returned. However, the particular weed you describe seems to be the so-called Cape Cotton, Balloon Cotton or Milky Cotton (*Gomphrena fruiticosus*), a native of South Africa, now common as a weed in secondary growth in much of coastal Queensland. It belongs to a dangerous family of plants, the *Asclepiadeæ*, and is probably poisonous, although so far as we have observed stock generally avoid it. The plant is sometimes grown in gardens as a curiosity on account of its balloon-like pods, but on many scrub farms it becomes a terrible curse, the seeds being widely spread by the wind. When cut the plant exudes a milky sap. The bark is very tough and possesses a rather useful fibre.

Guinea Grass.

W.H., (Pine Mountain)—

The specimen is the Guinea Grass (*Panicum maximum*), quite a valuable fodder grass, either for cutting or grazing off. It has been established in Queensland for a great many years, and judging from the number of specimens received during the last few months seems again to be coming into favour. We should say a grass such as Guinea Grass, Blue Panic, &c., would be valuable in small paddocks of, say, 2 to 5 acres for occasionally feeding down. Although it produces large seed heads, a big proportion of the seed is generally infertile, and propagation is probably best by division of the roots. This has probably affected the plant's popularity. It is not known to possess any poisonous or harmful properties at any stage of its growth.

Trees and Climbers Suitable for Longreach District.

A.McG. (Longreach)—

The trees worth while trying out at Longreach are—Currajong, Citron-scented Gum, Portuguese Elm (*Celtis sinensis*), Acacia (*Albizzia Lebbeck*), Parkinsonia Tree, Pepper Tree. Algaroba Bean, *Acacia arabica*, and Bottle Tree. Some of the Pines, such as the Native White Cypress (*Callitris glauca*), *Cupressus torulosa*, and the Chir Pine (*Pinus longifolia*), might be worth trying. Palms would be rather difficult to grow; the two you are most likely to succeed with would be the Cotton Palm and the Wine Palm (*Cocos Yatay*). Of climbers the following might suit:—Common Honey Suckle, Wistaria, Minettia, the Potato Vine (*Solanum Wenlandi*), Snail Flower (*Phaseolus caracolla*), and, if your frosts are not too severe, Bougainvilleas of different varieties.

In regard to vines that can be used both for ornament and for vegetables or fruits, the ordinary Passion Vine might grow if your frosts are not too severe. We do not remember having seen the Banana-fruited Passion (*Tacsonia mollissima*) in the West. It does not fruit well on the coast in Queensland, but your cold winters might aid in this respect. It fruits quite well in the neighbourhood of Sydney. Of climbing vegetables, two beans you could use are the so-called Poor Man's Bean or Hyacinth Bean (*Dolichos lablab*), or any of the climbing varieties of the Madagascar or Lima Beans. These would probably be best treated as annuals, although the Dolichos would last more than one year, provided your frosts are not too severe. The Botanic Gardens, Rockhampton, supplies plants, and some of the ornamental trees mentioned you could probably obtain from the Curator there, Mr. H. G. Simmons.

Wheat Grass.

A.E.H. (Mooloolah)—

The common Australian Wheat Grass is *Agropyrum scabrum*. It is very common in Queensland on parts of the Darling Downs. It is occasionally seen on the coast, but just as an occasional stranger. The grass varies very considerably in fodder value. The finer strains of it are found in the cooler parts of the State, and it is quite a good grass for the Granite Belt and parts of the Darling Downs, but in the warmer parts of the State it tends to become harsh and rather unpalatable. From our observations of the grass we should say it is primarily a sheep and cattle grass rather than one for the dairying districts.

Cockspur Thistle ("Saucy Jack"). Pimpernel. An Excellent Green Manure (*Phaseolus semierectus*).

D.O.A. (Atherton)—

(1) The taller growing plant with hairy leaves and stems bore only very young seed heads, but we should say it is *Centaurea melitensis*, the Cockspur Thistle, a very bad weed in the Southern States, where it is frequently known under the name of Saucy Jack. It is less common in Queensland, although it is often seen as a weed on farms on the Darling Downs.

(2) The other more succulent plant with green leaves bore neither flowers nor seed pods, but is evidently the Pimpernel (*Anagallis arvensis*), a very common weed on farm lands in the Southern States and in Southern Queensland. It is poisonous to stock, though only on rare occasions does it seem to be eaten by them.

Regarding *Phaseolus semierectus*, this plant is quite harmless. As a matter of fact, it was introduced as a fodder, though as far as we have observed stock do not take to very readily. We have had a lot of specimens in this year, and in some cases stock certainly do seem to be eating it, perhaps because other feed was not available. It is a native of Tropical America, but is now a naturalised weed in most warm countries. It is not known to possess any poisonous or harmful properties, and makes excellent green manure.

Mitchell and Flinders Grasses.

J.C. (Ilfracombe)—

In Dr. Hirschfeld's experiments, at least two sorts of Flinders Grasses and four sorts of Mitchell Grasses were experimented with. The seeds were sown in October, and, due to good late spring and early summer rains, there was a high percentage of germination, and the plants were in full growth in January. After the seed had been gathered from the Flinders Grasses stock were turned in late in April. The Flinders Grass had dried by this time, and what was left after seed had fallen proved very palatable to cattle, these grasses being sought first. Seed was not stripped from the Mitchell Grasses, and of the four varieties stock showed most preference for the Curly Mitchell, which is the commonest in Queensland. After that the Upright Mitchell, Hoop or Wire Mitchell, and Bull Mitchell were eaten in much the order given. It is often claimed by practical stockowners in the West that failure of Mitchell Grasses to germinate has been due to the absence of January rains, but in Dr. Hirschfeld's experiments the seeds definitely germinated with early summer or late spring rains. Our limited experiments at Lawnton and the Botanic Gardens have shown negative results. It is the opinion of stockowners that Mitchell Grass must be at least two years' old before stock are put on to it, otherwise they tear it up by the roots, but these conditions probably apply only to rather loose soil. Where the soil is heavy it would, we think, be quite safe to put stock on to Mitchell Grass within the first twelve months or even less. The trustees of the Walter and Eliza Hall Fellowship of Economic Biology of the Queensland University have recently appointed a Fellow for a term of three years to investigate the question of these native grasses. He is Mr. S. T. Blake, a graduate of the Queensland University, and it might be as well for you to get in touch with him. His address is care of the Biological Department, University of Queensland, Brisbane.

Broad-leaved Carpet Grass.

J.H.O. (Burrum)—

The specimen is the Broad-leaved Carpet Grass (*Paspalum platycaule*), a common tropical grass very abundant in North Queensland. It has been established in the more southern parts of the State for some years, and is now very much on the increase. It is quite a useful grass for second-class country, and on the whole we think much superior to the narrow-leaved variety that is causing some concern on the North Coast line as invading Paspalum pastures. This narrow-leaved variety of Carpet Grass is generally known as *Paspalum compressum* or *Axonopus compressus*, and is sometimes called Mat Grass. As far as we have observed in Southern Queensland, the Broad-leaved Carpet Grass (the form you send) prefers somewhat sandy land near the coast, and we do not think it is a potential danger to the better class Paspalum pastures.

General Notes.

Honoured by the King—Sir Geoffrey Evans, Former Director of Cotton Culture.

From the annual report of the Imperial College of Tropical Agriculture, now to hand, we learn that His Majesty the King, who is Patron of the College, has conferred on Mr. Geoffrey Evans the honour of Knight Bachelor. This is regarded as a well-merited recognition of his services to tropical agriculture.

Sir Geoffrey Evans is well known in Queensland, where he was some years Director of Cotton Culture in the Department of Agriculture and Stock, and where he has many friends to whom the news of the high distinction he has received from the King is especially pleasing.

In 1923 he was seconded by the Empire Cotton Growing Corporation as Cotton Adviser to the Queensland Government, and was later appointed Director of Cotton Culture while still retaining his association with the Corporation. His wide experience and organising ability were of great assistance to the cotton industry in this State during its early stages of development. In 1926 he was recalled to England and appointed Acting Principal of the Imperial College of Tropical Agriculture at Trinidad. In the following year he was appointed Principal, a post he has filled with marked ability and tact for seven years. Judging by the report, which covers a very wide field of instructional and research work, it is becoming increasingly evident that the efforts of the College to further the advancement of agriculture on scientific lines are recognised as of great value, and is widely appreciated.

Sir Geoffrey Evans served with distinction during the war, attaining the rank of Colonel with the decoration of C.I.E. Hearty congratulations are extended to him on the further recognition of his work and worth in the field of tropical agriculture.

Services of the Public Curator.

The following information is supplied by the Office of the Public Curator:—

The Office of the Public Curator has been specially created so that the people of Queensland will always have available a continuous service in all trustee and agency work, and thus avoid the many dislocations often evident in individual appointments. The service also provides for the preparation of taxation returns for clients.

The intricacies of modern tax legislation are not too readily understood by the bulk of the people, and the need is felt for advice from men who are fully conversant with all the requirements of the taxation authorities. No one is expected to pay more tax than is required, but often, because of lack of knowledge, taxpayers return as income moneys which should not be classed as such. The expert can advise you on all these and many other points, and help you in many ways to avoid bearing more than your equitable burden from taxation.

You are well advised to consider what help you need with your returns, which you are now required to lodge. The service includes, too, the receipt and checking of your assessment, and refers to all taxation returns, including land and income tax.

Another service to-day notified is that the Public Curator has always ample trust funds available for advancing on approved freehold security. You should call or write for further information direct to the Public Curator, Edward street, Brisbane, or to the Branches at Rockhampton, Townsville, and Cairns, or to any Clerk of Petty Sessions in the State. These latter are all agents for the Public Curator.

Order to Dip Stock.

Executive approval was given to the amendment of Regulations under the Diseases in Stock Acts dealing with the order of an inspector to dip infected stock. Actually, the amendments involve slight changes in the form of order to dip which the inspector issues to an owner of infected stock. The general procedure for the dipping and treatment of infected stock remains the same as that at present in force.

Staff Changes and Appointments.

Mr. H. J. D. McBean, Inspector of Stock, Milmerran, and J. T. Smallhorn, Inspector of Stock, Miles, have been appointed also Inspectors under the Dairy Produce Acts.

Mr. F. C. Coleman, Inspector of Dairies, has been appointed also an Inspector of Stock. Mr. Coleman is stationed at Pittsworth.

Acting Sergeant R. F. Dawson, Sarina, has been appointed also an Inspector of Slaughterhouses.

Mr. T. Ellis, loader for the Committee of Direction of Fruit Marketing at Eudlo, has been appointed also an Inspector under the Diseases in Plants Acts.

Mr. D. C. B. Nunn (Boonah) has been appointed an Honorary Ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Mr. A. M. Taylor, Clerk of Petty Sessions, Ayr, has been appointed an Agent of the Central Sugar Cane Prices Board for the purpose of making enquiries in pursuance of the provisions of the Regulation of Sugar Cane Prices Acts in regard to sales and leases of assigned lands, and the appointment of Mr. T. R. Kennedy, Bowen, as an Agent of the Board has been rescinded.

Constable J. W. Wilson (Turn-off Lagoons) has been appointed also an Inspector under the Slaughtering Act.

Mr. E. H. Harding (Palmwoods) has been appointed an Honorary Ranger under the Native Plants Protection Act.

Mr. A. F. Moodie, Inspector of Stock, Julia Creek, has been transferred to Hughenden, and Mr. C. E. Ellis, Inspector of Stock, who has been stationed at Hughenden, will be attached to the Killarney district.

Mr. S. E. Stephens, Instructor in Fruit Culture, at Cairns, has been appointed also an Inspector under the Apiaries Act and the Diseases in Stock Acts.

Constable A. McElrea, of Mourilyan, has been appointed also an Inspector under the Slaughtering Act.

Mr. L. G. Miles, B.Sc.Agr. (Q'ld.), who has been abroad for the past three years studying plant genetics, has been appointed Plant Breeder, Department of Agriculture and Stock.

Mr. R. Mahoney has been appointed Assistant Cane Tester at the Marian mill for the forthcoming sugar season, as from 18th July, 1934.

Messrs. C. H. Jorgensen and L. G. F. Helbach, whose appointments as Cane Testers at the Mourilyan and Isis mills, respectively, were recently approved, have now been appointed to the Isis and Mourilyan mills.

Constable J. E. Carroll (Stonehenge) has been appointed also an Inspector under the Brands Acts.

Mr. E. R. Ashburn, Instructor in Agriculture, Bowen, has been appointed also an Inspector under the Diseases in Plants Acts.

Messrs. N. C. Copeman and H. A. McDonald, Inspectors of Stock at Wandoan and Jandowae, respectively, and Mr. J. R. Canty, Inspector of Slaughter-houses at Innisfail, have been appointed also Inspectors of Dairies.

Grade Standards for Banana Plants.

Regulations have been issued under the Diseases in Plants Acts prescribing grade standards for banana plants, and no person shall sell or offer for sale any banana suckers or bits unless they comply with the standards prescribed. The standards are:—

Suckers.—A sucker is an offshoot from the corm of a mature plant from a planting not less than twelve months old, provided that the corm of such sucker shall be not less than three inches in any diameter below the point of commencement of development of the pseudostem.

Bits.—A bit is a portion of a mature corm of a banana plant, provided that such bit shall consist of a well-developed, undamaged "eye" protruding not less than ½ inch above the surface of the corm to which it is attached, the eye to be not less than 1½ inches from any edge, width of surface to be at least 4 inches, and depth behind eye at least 3 inches.

Suckers and bits intended for sale shall be removed by the vendor from his plantation on the same day as they are trimmed at least half a mile from any banana plantation, provided that an agent of the Banana Industry Protection Board may authorise their removal to a place which he considers safe from beetle-borer infestation.

Queensland Royal National Show.

The Queensland Royal National Show, to be held 6th to 11th August, is acclaimed by all sections of the community as the most important agricultural event of the year. Queensland's winter sunshine is attracting thousands of inter-State visitors to the Royal Show each year. This year's ring programme will extend over eleven sessions—six days and five nights—and will include one of the most comprehensive series of hunting, jumping, and trotting events so far presented in Brisbane.

In the Women's Section of the Show, which comprises Women's Industries in all branches—Arts and Crafts, Photography, Cookery, Home Preserves, &c.—entries are exceptionally heavy, thus ensuring a fine display. Queensland women are among the most resourceful in the world, and the work displayed in this section should attract great public interest.

The Royal National Show is first and foremost educational, and this phase is exemplified in the Farm Boys' Camp. Each year 15 boys are selected from the Project Clubs throughout Queensland; a party of 10 boys has been similarly selected in New South Wales for the Brisbane Show. This year the movement is to be further extended by the establishment of a Girls' Section. As a commencement, 10 girls will be selected as guests of the Association, and a similar syllabus to that of the boys will be prepared for their education and entertainment throughout Show Week. Each section of the camp will be under the control of responsible officials right from the time of their arrival in Brisbane to their entrainment for the homeward journey after the Show. The Boys' Section will be quartered in the Valley State School; while the contingent of girls will be accommodated at the Y.W.C.A.

The Wool Exhibit which was so successful last year is to be again staged, and will be considerably enlarged. It is anticipated that several hundred sheep will be housed on the showgrounds and frequent sheep-shearing demonstrations will be given throughout show week. It is surprising how few people have actually seen sheep being shorn, and these demonstrations afford a convenient opportunity for witnessing an important feature of this truly Australian industry. It is, perhaps, on the manufacturing side that the wool exhibition is most impressive, and the forthcoming displays will reflect remarkable progress in the production of beautiful and artistic articles of personal apparel fabricated from wool.

Brisbane Catchment Area a Bird Sanctuary.

An Order in Council has been issued under the Animals and Birds Acts declaring No. 5 Division, Shire of Moreton, the Brisbane Water Catchment Area, Mount Coot-tha Reserve, and adjoining lands as a sanctuary for the protection of native animals and birds.

The Brisbane Water Catchment Area, the Mount Coot-tha Reserve and adjoining lands were declared a sanctuary a few years ago. However, requests have lately been received for the declaration of sanctuaries in various parts of the No. 5 Division of the Moreton Shire, and as about one-third of this Division is already included in the abovementioned sanctuary, a new Order in Council to cover the No. 5 Division and lands previously declared a sanctuary has been issued.

Messrs. C. Christie, R. Worley, K. Williams, and C. Mason, of the Ipswich district, have been appointed Honorary Rangers under the Animals and Birds Acts. The property used by these Scouts for a training ground is situated within the boundaries of the abovementioned sanctuary.

Instructional Course for Dairy Farmers and Pig Raisers at Gatton.

Professor J. K. Murray, Principal of the Queensland Agricultural High School and College, Gatton, advises that a short course of instruction for dairy and pig farmers will be held from 13th August to 23rd August, 1934. The course will cover lectures and demonstrations, also visits to the Brisbane Abattoirs and bacon factories. The fees will total £3 10s., covering tuition, board, and visits to factories. Further particulars and rail concession forms on application to the Principal of the College at Gatton.

Cheese Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts giving notice of intention to extend the operations of the Cheese Board for the period from 1st August, 1934, to 7th February, 1935. Provision is made for the lodgment of a petition on or before the 16th July, to be signed by not less than 10 per cent. of cheese manufacturers and suppliers of milk to cheese factories, requesting that a poll be held on the question of the continuance or otherwise of the board.

Oversea Shipment of Poultry—Customs Department Requirements.

Following are the conditions of the Customs Department for acceptance of consignments overseas. These conditions are intended as a guide for shippers, and unless they are reasonably complied with the Customs Department may refuse to pass the birds for shipment—

For the crating of fowls, ducks, geese, and turkeys for shipment overseas, it is desirable that the coops be constructed of wood, and the front be covered either with wire-netting or slatted battens, the latter preferred. The top should be sloping and the boards lapped to shed any water. Where the birds have to travel through the tropics, ample ventilation should be provided by leaving an aperature of about 2 inches along the back near the top of the coop, or by holes 1 inch in diameter bored in the back and ends near the top.

Water vessels should be provided, preferably of a type which will hang on to the front of the coop with a metal strap.

The minimum sizes desirable for the various classes of birds mentioned being despatched on a journey of seven days or over are as under, but reasonable latitude may be allowed if the journey is under seven days, as to New Zealand and Lord Howe Island.

Fowls.—For single birds the coop should have a floor space of 3 square feet (2 feet × 1 foot 6 inches) and a height of 2 feet at the back and 2 feet 3 inches in the front. Where more than one bird is being sent, not less than 2 square feet of floor space per bird should be allowed, and not more than one male bird should be put in one compartment.

Ducks.—Coops should be constructed the same as for fowls, except that the height need not be more than 2 feet at the front. An allowance of 3 square feet of floor space (2 feet × 1 foot 6 inches) should be made for single birds or 2 square feet each where more than one bird is in the compartment.

Geese.—Coops should be of the same construction as for fowls except that the height should be 2 feet 3 inches at the back and 2 feet 6 inches in front. Five square feet of floor space should be allowed for single birds (2 feet 6 inches × 2 feet) or 3 square feet each where more than one bird is in the same compartment.

Turkeys (Gobblers).—Coops should be built in the same manner as for fowls, except that the height should be 2 feet 6 inches at the back and 2 feet 9 inches in front. About 9½ square feet of floor space (3 feet 9 inches × 2 feet 6 inches) should be provided for a single gobbler or 6 square feet each where more than one gobbler is in the same compartment, but preferably gobblers should be in separate compartments, in which case 9½ square feet should be allowed.

Turkey Hens.—For single hens the floor space should be 6 square feet (3 feet × 2 feet) or 4 square feet per bird where more than one is in the same compartment, and the height may be 3 inches less at front and back.

Quarantine Area on the Near North Coast.

A Proclamation has been issued, under the Diseases in Plants Acts, declaring the parish of Mooloolah and portions of the parishes of Bribie and Maroochy to be a quarantine area for the purposes of the Acts. This Proclamation also rescinds a Proclamation issued on the 27th February, 1930, which prescribed the existing boundaries of the quarantine area to be between the Maroochy River and the main Caloundra-Landsborough road.

This action has been considered desirable in view of the progress of bunchy-top infestation northward of the boundaries of the present area, and, in addition to taking in the areas where bunchy top has recently made its appearance, it will also provide what is looked upon as a safe margin.

Butter Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts extending the operations of the Butter Board for the period from 1st July, 1934, to 7th February, 1935. The Order further provides that the present members of the Board—namely, J. Purcell (Toowoomba) (chairman), W. J. Sloan (Malanda), R. M. Hill (Bororen), J. McRobert (Maryborough), T. F. Plunkett (Beaudesert), A. G. Muller (Fassifern Valley, Kalbar), and E. Graham (Director of Marketing), whose period of office terminates on the 30th June, shall continue in office until 7th February next.

Purchasing Store Pigs.

A word of advice to those who intend purchasing or who regularly make a practice of buying store pigs will not be out of place, seeing that a number of instances have been recorded recently in which bad results have followed the purchases and money has been lost on the transaction. Inexperienced persons who set out to purchase pigs for finishing for market should endeavour, wherever possible, to secure pigs not less than fourteen or sixteen weeks old.

It is disastrous buying pigs six weeks old and expecting them to make progress or to prove satisfactory, especially as these very young unweaned pigs often cost more at auction than those carrying more age. There is an old saying, "Never buy a pig in a poke," which literally means never buy a pig of whose breeding or development you know nothing. Fortunately, under the conditions on which pigs are offered for sale at public auction in this State, the buyers' name and postal address must be announced before the pigs are offered for sale, but though this is a valuable safeguard against the spread of disease it is not everything, and buyers should certainly know something of the conditions under which the pigs intended to be purchased have been developed, the foods used in their production, whether they come from a farm free of disease, the breeding, age, and any other information available. The purchase of pigs from breeders with a well-known good reputation is usually a safe proposition, and it would be preferable to purchase only from well-known breeders if we are to succeed in our efforts to eradicate and/or trace disease to its source of origin. Lice, worms, and other parasites that infect the pigs are readily conveyed from one to another.

When selecting pigs from a litter, for delivery after weaning at correct age, secure the strongest and best. They will repay the extra cost of two or three shillings per head and prove to be good buying. The same may be said of purchasing stock already weaned and making good progress. Never buy pigs manifestly diseased or with abscess formation, ruptures, piles, or open and suppurating wounds. It is wise to have the stock or dairy inspector have a look at the pigs you intend purchasing in order to have an additional safeguard. It is best to avoid purchasing pigs which are in poor, emaciated condition or are stunted in growth and which give evidence of unthriftiness. Avoid purchasing where the pigs are crowded together in a small and possibly a badly lighted pen, for some sellers are so unscrupulous that they will pack a few ruptured or unhealthy pigs in among a lot of better-class stock in order to reap a benefit of the few extra shillings which better pigs would, in any case, realise.

If there is the slightest doubt about the transaction throw the responsibility on the auctioneer or the vendor and have them explain why certain diseased pigs were sold by them. These are all matters of commercial interest to farmers, especially those who wholly or partly depend on the purchase of store pigs for finishing. Store pigs are those between approximately two and a-half and four months of age, midway between weaner and "slip" stage and light porkers (four to four and a-half months).—E. J. SHELTON, Senior Instructor in Pig Raising.

State Schools' Eisteddfod.

The Queensland State Schools' Eisteddfod will be held at the City Hall, Brisbane, from 13th August to 18th August. The purpose of the Eisteddfod is to demonstrate the high standard of musical performance attainable in Queensland schools, and to allow teachers and pupils the benefits of comparison and criticism by an eminent musical adjudicator.

Special railway fares have been arranged for country competitors. For children a special rate at one-quarter the regular adult excursion fare will be charged. Conductors and pianists will be charged one-half the adult excursion fare. Parents and other grown-ups travelling to the Eisteddfod will be charged at the special rates prevailing for Exhibition Week.

Visiting choirs will be billeted with children attending Brisbane schools, on the basis of one or two visitors to each home, so that children from country schools who are members of a school choir will be saved the expense of accommodation.

It is intended to make the Eisteddfod programme a very attractive one, and the whole week should be enjoyable to those who make the journey. Furthermore, the reduced fares (both for children and adults) should make the time a favourable one for a holiday visit to Brisbane.

The farmers' support of the venture should do much to ensure its success.

Trees on the Farm.

The advantages of windbreaks on a farm are:—

Firstly, they break the mechanical force of the wind, thus preventing undue damage to orchards by breaking off limbs, blossoms, and fruits. The production of blossoms, fertilization, and maturing of fruits cannot be satisfactorily carried out in places open to the full force of high and frequent winds. Further, the lodging and damage by wind of other farm crops, such as maize, &c., can be prevented largely by suitable shelter belts.

Secondly, they provide a very necessary shelter for stock of all descriptions. To see a mob of cows or sheep huddled beneath a tree during the bitter winds of winter is to realise that the health and well-being of stock demand the provision of some efficient shelter. Too much food material is wasted in "warming the wind," or in meeting the increased demands of an exposed body. Sheltered animals require less food. Stock-owners agree that mortality among sheep, particularly during lambing and shearing seasons, would be considerably lessened if good shelter were available. Animals clearly demonstrate their need for shelter, and if the stock-owner were to provide it he would add considerably to his profit.

Thirdly, windbreaks prevent soil erosion and removal of topsoil due to unrestricted wind action. This is particularly in evidence where light soil predominates and little natural cover exists. The effects of dust storms are mitigated.

Fourthly, they reduce evaporation and help to conserve the soil moisture. Where the wind is unrestricted, evaporation goes on at a rapid rate. In the immediate lee of a windbreak evaporation is reduced by as much as 60 per cent., and actually at one point it has been shown, under ideal conditions, to reduce evaporation by 70 per cent. The protective zone of a break varies with local conditions, but, generally speaking, it shelters an area equal in width to six to fifteen times the height of the trees. A narrow strip is also protected on the windward side. In the protected zone the average reduction in evaporation falls round about 30 per cent., the moisture retained in the soil being available for crop needs.

The actual result of a breakwind in reducing evaporation is therefore equivalent to a fairly large increase in rainfall. Areas unsuited for certain crops by reason of an insufficient rainfall might, therefore, be made to grow them profitably if protected by efficient breaks.

Fifthly, when planted near dwellings, they add greatly to the personal comfort of the farmer by protecting the home buildings from the extremes of winter cold and summer heat, and from dust storms. The home is made an infinitely more pleasant place to live in if the owner will go to the small amount of trouble entailed in planting a belt of trees.

Lastly, when planted on a big scale they can be made a source of timber and fuel supply for farm needs, and even assume the character of a tree plantation.

The claims of the windbreak can hardly be ignored by the orchardist, farmer, or pastoralist.

Farming's Inevitable Gluts.

The history of agricultural effort the world over has been an inevitable series of booms and serious depressions. Is it possible to "iron out" these high and low peaks? Some of the best brains of the world have applied themselves to the problem, and they turn to international control as a remedy. Yet the brilliant young English economist, H. V. Hodson, whose book, "Economics in a Changing World," is already almost a classic, speaks thus of the quota and other restrictive remedies: "As a nostrum for the world's economic ills they rest on the profound fallacy that the paradox of poverty in the midst of abundance has its sole solution in perpetuating poverty by abolishing the abundance."

Yet the same clear thinker has to admit that primary production does tend to increase faster than the effective demand, and that this lends an element of instability to the whole business system. "The reason is," he says, "that primary production increases in efficiency with the aid of mechanical and chemical science, at least as rapidly as the total wealth of the world. On the other hand, as real income increases, a diminishing proportion of it is devoted to primary products, and a rising proportion to the higher stages of manufacture, and to services of all kinds. Thus, until the least efficient producers are squeezed out, primary prices have a perpetual tendency to fall, periodically, to quite unremunerative levels."

These extracts, only a trifling proportion of the quantity of informative and thought-provoking material which has come under the writer's notice, are reproduced to show how the problem is vaster than is possible of final and complete handling by any board representing the producers of an industry. Governments have taken a hand in trade policy all over the world, and only Governments can deal with Governments.—"The New Zealand Farmer."

Bacteria in Milk and Cream—Sources of Contamination.

Bacteria thrive in milk, and every precaution must be taken to prevent their entry. This susceptibility, and the fact that bacteria are everywhere, makes the production of a sterile milk by the farmer impossible, but knowledge and avoidance of the chief causes of contamination should enable him to market a very satisfactory product, writes an officer of the Biological Branch of the New South Wales Department of Agriculture.

The Cow.—Milk is contaminated before it leaves the healthy cow. There are always some bacteria living in the milk ducts, &c., but luckily these forms are rarely numerous and seldom cause a noticeable change in milk, even after standing for many days. However, should the udder be in a diseased condition the milk may be abnormal before it leaves the cow. Ropy or curdled milk is often drawn under these circumstances.

Materials adhering to the outside of the teats and udder frequently bring about important contamination. When the cows rest at night time this portion of their body comes into direct contact with the ground and becomes smeared with droppings, &c., which contain extremely high numbers of bacteria. From here they readily gain entry to the milk. A similar process brings about contamination from the tail, which is always in an insanitary condition. Particularly during the spring and summer months, the fly pest causes the tail to be in constant motion, and unless more than ordinary care is observed, the tail will find entry to the bucket during hand-milking.

Contamination from the Air.—Varying amounts of contamination take place from the air in and around the milking bails. Some yards are dusty, and unless the cows are all in a contented mood, a certain amount of milling takes place and results in flying dust. Such dust has invariably been fouled and adds large numbers of bacteria to the milk. Again, the practice of feeding hay or silage to the cows while they are being milked is sometimes followed. Yeasts, moulds, and bacteria gain entrance to the milk from this source.

The Careless Milker.—In some instances carelessness on the part of the milker results in contamination. Unwashed hands are always insanitary, while hands which may have been thoroughly clean at the outset soon become dirty, as a result of contact with the animal. Some people have the habit of "wet" milking, and this is much more insanitary than the "dry" method.

Water as a Source of Contamination.—On several occasions faults in milk and cream have been traced to stagnant water. While the popular belief that the drinking of such water is, in itself, the cause of subsequent deterioration is unfounded, the fact remains that bacteria from such water often gain indirect entry to the milk. Mostly the cattle wade in a polluted swamp searching for watercouch, or they may even have to cross a stagnant creek in being driven to the milking yard. The body, including the teats and udder, is fouled in this manner and the bacteria are later added to the milk while it is being drawn.

The biological quality of the water used for washing down the udder is also of importance. When cow after cow is washed with the same cloth and water from the same pail the water becomes more and more insanitary and a source of pollution to the milk. Sometimes the water is unsuitable at the outset, being taken from iron tanks in which manurial dust, blown from the yard to the roof and washed down the spouting, has been allowed to accumulate for months.

Unsuitable and Dirty Utensils.—By far the greatest number of bacteria are derived from the utensils. Kerosene or petrol tins have a groove at the bottom from which it is impossible to remove all traces of milk. This material supports the development of large numbers of bacteria which attack the fresh milk immediately it is poured into the can.

Concerning the value of a milking machine on the farm, there are two very definite opinions, and one of the strongest arguments used by those who condemn the machine is the irregular quality of the milk drawn through it. Naturally there are many places in which bacteria may become lodged in the mechanism. In earlier patents, communication of condensed water or trapped milk from the air line to the milk line frequently occurred, and even with recent models if the units are not conscientiously dismantled and cleansed, serious contamination of the milk soon results.

Next to the milking machine the separator may be classed as the most likely source of contamination. The discs are the chief trouble. Much casein and other slime becomes settled between the individual discs during the skimming process. The removal of this material necessitates extreme thoroughness of washing, with the result that some of it is frequently left behind and breeds up an undesirable

inoculum for the next separation. Even when carefully washed the discs are often left so close together that they fail to dry, and in the droplets of water between them bacteria, and often rust spots, develop.

Cloths.—In many dairies cloths find favour as an aid in the washing up process; and in many dairies cloths are a source of contamination which results in the rapid deterioration of the quality of milk and cream. Cloths retain the fat, casein, &c., and unless carefully spread out take a long while to dry. Under such conditions they rapidly become foul-smelling and are a source from which countless micro-organisms gain entry to the milk. If kept sanitary by careful washing, rinsing, boiling, and quick drying, a cloth is probably less dangerous than a brush, for in the latter it is practically impossible to free the base of the bristles from greasy materials.

Facts about Animals.

The Creator gave various animals special prehensile organs and attributes to enable them to exist in the same environment. Observation makes some of these special features apparent and it would be well for every young farmer to note them in the animals he has to feed.

Many of them, however, have not been noticed by the average stockmen, and are worth mentioning. For instance, the sheep has a cleft upper lip, that it may spread the sections apart and get its teeth close to the ground for short herbage cropping.

The cow takes its forage in a different fashion. Her tongue is rough like a rasp, and with it she gathers between her eight incisor teeth of the lower jaw and the cartilaginous pad of her upper incisors, locks or tufts of grass which she then wrenches and cuts off for mastication with her molar or grinding teeth. In a time of drought, when grass is dry and loose in the ground, the roots, with some soil attached, commonly enter the cow's mouth with each tuft of grass; but the cow discards the soil and it falls from one side of her mouth. At such times one will find little heaps of this discarded soil everywhere on the pasture. This is not done by the pasturing horse. The rigid teeth of the upper and lower jaw seize a tuft of grass and cut it off for chewing. If soil comes with the grass it is swallowed, and so much "dirt" or sand may be thus taken in as to cause indigestion or colic, which often proves fatal.

The horse's tongue is long, slim, and smooth, instead of being rasp-like, and the ridges of the horse's hard palate are also smooth, as is the lining membrane of the cheeks. Look into the cow's mouth and you will see that some long, teat-like objects (papillæ) project from the inner surface of the cheeks, especially on a level with the grinding surface of the molar teeth, and the ridges of the palate are also rough, with saw-like edges pointing backward.

The papillæ and points of the palate ridges or "bars," together with the roughness of the tongue, are intended to help the cow retain the feed in her mouth while chewing her cud. A farmer once wrote us that when his cow was sick he looked in her mouth, saw the papillæ mentioned, thought they were warts, cut them off, and reported that the cow was not a bit better after the operation. It is well to know the facts about such anatomical features.

That is also true regarding the teeth. The incisor teeth of the cow normally or naturally are somewhat loose in their sockets, but the looseness has often been blamed to the eating of silage, by the uninformed stockman. So has the early wearing away of the cutting parts of the incisor teeth. That occurs when the cow is ageing, so that when she is twelve years old, and sometimes when she is younger, one may find little rounded stubs, like collar buttons, projecting from the gums, instead of large, broad, shovel-shaped teeth. The broad parts quickly wear off and the slim necks remain. In the horse, however, the incisors, above and below, last the animal until it is twenty or more years old.

The hog "goes" the cow and horse "one better" when on pasture. It roots below the surface to obtain feed, grubs, minerals, &c., and, therefore, is fitted with a special bone in its snout and a ring of strong gristle as well, to make rooting possible; and speaking of extra bones, you will find two of them in the cow's heart, but none in that of the horse. A moment of thought will enable the reader to understand, with these facts about domestic animals, why the giraffe has such a long neck, the elephant its trunk, the ant-eater its elongated proboscis, the carnivorous or flesh-eating animals their fangs and bone-crushing molars, and the feline animals their claws, which have special muscles to keep them hidden or spring them into savage action.—"Hoard's Dairyman."

The Imperial Sentiment.

Unfortunately the strongly expressed feelings of the British farmer in regard to disastrous competition from the Dominions, and the latter's resentment of proposals for regulation, have led to a feeling of constraint, which is not going to improve Imperial relations. This factor is realised in England, and it is good to find so important a journal as the London "Times" reproducing on its leading-article page, in issues just to hand, a series of articles on the whole situation, written with special regard to the viewpoint of the overseas countries of the Empire. These are lengthy contributions, very faithfully covering all aspects, and the opening paragraph will be read by our own producers with the greatest interest:—

"What is prudence in the conduct of every private family can scarce be fault in that of a great Kingdom. If a foreign country can supply us with a commodity cheaper than we can ourselves make it, better buy it of them with some part of the produce of our own industry employed in a way in which we have some advantage. Adam Smith in 1776," continues the writer, "gave this exhortation which seems to be the veriest commonplace. Yet in December, 1933, the wholesale price of butter was 69s. per cwt. in London, 184s. in Berlin and Belgium, and 238s. per cwt. in Paris. These prices give some indication of the extent to which the commercial policy of nations has departed from the commonsense of the economists."

The agrarian policies of Continental countries is explained, some of the illuminating facts quoted being that Switzerland has, through its changed policy, reduced butter imports from 200,000 cwt. in 1931, to 10,000 cwt. last year. Although in 1928 the Continent was importing six million cwt. of beef per annum, this has been reduced to four million cwt., and the process involved increasing pressure on the only open market, Britain, and, as the writer remarks, "until the Ottawa quota began to operate, the pressure of superabundant supplies was having a disastrous effect upon the price of domestic beef."

Britain's increasing ventures into protection for its farmers is described, wheat in Britain, for instance, being twice the price of world parity, while the encouragement of the beet-growing industry results in sugar having to be produced at a quite uneconomic price, compared with that in the normal sugar-producing countries. "If the present state of affairs continues," comments the writer, "we shall be forced to contemplate the wholly unsatisfactory spectacle of the low-cost producers of Denmark, New Zealand and Canada or Australia, being forced to abandon their farms because Governments of the industrial countries are determined to make production remunerative to their own sub-marginal producers. This is a challenge to economic sanity."

The last point leads up to the question of what the British Government will regard as a "remunerative" price, and for whom? The reasonably efficient, or the inefficient farmer? The explanation of the new agrarian policy of the British Government, as given by this obviously well-informed writer, is that it is determined to use the bargaining-power of its great market for food-stuffs, to promote export trade in manufactures, combined with the desire to secure prosperity for the Home agriculturalist. It is the harmonising of these factors, with the natural desire of the Dominions to expand and develop, which is the problem of to-day.—"The New Zealand Farmer."

How to Pit Potatoes.

A level piece of land, so situated as to ensure drainage, should be selected for the pitting of potatoes for winter storage. Two poles or saplings are placed on the surface, parallel to one another and 4 feet apart, and the potatoes are emptied in between these so as to form a well-ridged heap. The potatoes are then covered with a thatch of straw or other suitable material, and this again is covered with sods of earth. It is important that the sodding should be done from the ground upwards (as in shingling a roof). When completed, the whole is beaten well down with the back of a spade, and a drain is cut round the put to run off the water in case of rain.

Potatoes for pitting should be as dry as possible. If weather permits, it is well to let a fortnight or so elapse before earthing up—that is, to leave the potatoes with only their straw covering so that sweated moisture may be carried out. For a small pit (say 1 ton) the best shape is a cone.

It should be remembered that unnecessary exposure causes a deterioration in quality. Light causes a greening of the skin, and even a partial exposure may cause a yellowing of the flesh.

Colic in Horses.

It is extremely difficult to differentiate between the various gastric and intestinal affections in the horse, and most complaints seem to be placed under the heading of colic. The name is given to a train of symptoms which horses show when they have pain in the abdomen. In the horse two forms of colic are distinguished, namely, spasmodic and flatulent—

In spasmodic colic the pain is not continuous, but there are intervals of ease between the spasms, during which the animal appears quite well, until another spasm suddenly occurs. The animal is generally violent, paws, stamps, kicks at its belly, lies or throws itself down, rolls, crouches in the loins when walking, stretches itself out, looks round at the sides, and sweats either in patches or all over. The pulse is fast, the breathing hurried and distressed, and the mucous membrane of the eye is red, but the temperature remains normal. Between spasms the animal appears quite well, and will start feeding if allowed. As the attack progresses, the pains get more frequent and longer, and the intervals free from pain shorter. Constipation is a symptom as a rule.

The animal should be walked about, and on no account permitted to lie down or roll. The following drench should be given at once:—1 drachm oil of peppermint, 2 ounces aromatic spirits of ammonia, 1 pint linseed oil. Keep well shaken, and drench slowly.

If relief is not obtained in an hour, repeat the mixture, substituting thin gruel for the linseed oil. This may be repeated till three doses have been given, at intervals of an hour. Apply hot fomentations to the abdomen for periods of half an hour at a time, keeping the temperature of the water so high that the hand cannot be kept in it—half-cold fomentations are quite useless—or mustard mixed sloppy in a basin with vinegar may be rubbed over the belly. Give copious enemas every hour. If, in spite of this treatment, the animal is still not relieved, give the following drench, repeating if necessary every three hours:—1 ounce chloral hydrate, 1 pint thin gruel.

Flatulent colic is due to fermentation of the food in the bowels, which become distended by the resultant gases. The belly is inflated, giving the animal an unnaturally round appearance, and the pain is continuous, though not so violent as in the spasmodic variety. The animal does not throw itself about so much, but appears somewhat sleepy, though uneasy and fidgety, scraping, wandering slowly round, attempting to lie down, but afraid to do so.

The following drench should be given at once:—2 ounces oil of turpentine, 2 ounces aromatic spirits of ammonia, 1½ pints linseed oil. Shake the drench very frequently whilst giving.

Walk about and give enemas and fomentations as in spasmodic colic. If the pain is not relieved in two hours, give an ounce of oil of turpentine in a pint of thin gruel, and repeat again in two hours if necessary. If still not relieved, give the chloral hydrate as in spasmodic colic. As an after treatment, when the pain has subsided, feed the animal on bran mashes for twenty-four hours. It is also best not to work the horse for two or three days.

In drenching, if the animal struggles, or attempts to cough, immediately lower the head. A portion of the drench may be wasted, but unless this is done the fluid will be likely to pass down the windpipe, and the horse die of pneumonia.—A. and P. Notes, New South Wales, Department of Agriculture.

Kikuyu Grass Sets Seed.

The first record of Kikuyu grass (*Pennisetum clandestinum* Chiov) forming seed in Australia comes from the Comboyne district, New South Wales. Writing to the New South Wales Department of Agriculture on 26th March last, Mr. Les. Pfeiffer stated that for several years past on his property this grass had formed the female portions of the flowers, but that this year a small patch was bearing complete flowers and setting seed. On 16th April he forwarded specimens of immature flowers and also mature ones carrying seed.

The Comboyne plateau is 1,900 feet above sea-level, and the average annual rainfall over a period of eight years is 63.80 inches.

Kikuyu grass was first grown in Australia from seed obtained by us from the Belgian Congo in 1919. This seed was planted at the Botanic Gardens, Sydney, and sufficient cuttings were thereby obtain to enable a plot to be planted at Hawkesbury Agricultural College, Richmond. Most of the Kikuyu grass now growing in this and other States was distributed from these two centres.

Points for Pig Raisers.

The ambition of the pig raiser should run along something of the following lines:—

More pigs per litter and more weight for age.

Better and healthier pigs and more protection from disease.

Lower mortality and better control of disease.

Better proportioned and more attractive carcasses and more profitable returns.

* * * * * *

Improve the condition and increase the stamina of your pigs by using properly balanced rations, by regularity of feeding, and by keeping the pigs under strictly sanitary conditions.

* * * * * *

The liberal use of minerals, and, where necessary, of the commoner drugs, will do much to ward off disease and enable pig raising to be carried on with a greater margin of profit. Properly compounded mineral mixtures are invaluable for developing bodily strength in the animals and in generally improving the health of breeding and young stock.

* * * * * *

What should a litter of pigs weigh at three weeks of age? A well known manufacturer of commercial pig meals in Great Britain advertises that under efficient management and with properly balanced foods a fair average would be 7.5 pigs at 10.5 lb. each, equally 78.75 lb. per litter. The firm referred to claims that by the use of their food it is quite possible to increase this average to 8.39 pigs at 12.4 lb., equally 104.8 lb. at three weeks of age. They like their customers to regularly weigh their pigs.

Deficiency Disease in Cows.

Referring in a recent report to cases of deficiency disease in dairy cows on the Central New South Wales Coast, the Chief Veterinary Surgeon of the New South Wales Department of Agriculture draws attention as follows to the value of a sterilised bonemeal lick:—

"There appears to be a tendency rather to use complicated licks for cattle suffering from phosphorus deficiency when in reality bonemeal or dicalcic phosphate is the only thing required in addition to common salt. Alternatively, of course, the necessary mineral matter may be provided to the cattle through using artificial fertilizers on the pastures, and the benefit derived would be very greatly increased were the farms more markedly subdivided. In connection with the use of steriilsed bonemeal and the value to be derived from its use, reports on investigations recently carried out in Florida are to hand. These reports stress the point that in very deficient country regular access to bonemeal is required over a prolonged period if cattle are to be expected to produce satisfactorily and to breed at the same time."

Horse Market Revival—Stallion Parades.

The Minister for Agriculture and Stock (Mr. F. W. Bulcock, M.L.A.) has expressed his satisfaction at the revival in horse sales in many country centres, as indicated in recent press reports. The Minister also referred to the Stallions Registration Acts, which have for their primary object the elimination of the unsuitable and unsound horses of all breeds, and expressed the opinion that this desirable objective could only be achieved with the co-operation of breeders and owners. Mr. Bulcock emphasised the necessity for owners complying with the legislative provisions, which insist on examination and registration of stallions.

Arrangements are now in progress for the annual examination of stallions, which will be carried out during the next two or three months at various centres appointed for that purpose, and the attention of owners is directed to parades advertised in metropolitan and district newspapers. Strict compliance with the provisions, which prescribe compulsory registration, is to be enforced in future.

At any sales held intending purchasers of stallions should insist, for their own protection, on the production of a certificate of registration of the animal under the Stallions Registration Acts, as uncertificated horses are prohibited from being used for either public or private service.

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

PLAYING WITH BABIES.

This article appeared in the newspapers of New Zealand a few years back.

A RECENT spectacle of a bright, intelligent baby being treated as a plaything by every member of the family concerned leads us to touch once again on this subject.

Play is a natural instinct which man has in common with the lower animals. It seems that the higher an animal comes in the scale of creation the more highly developed is its instinct for play. When we come to the domestic animals we see playfulness developing in proportion to the intelligence, and in the apes and monkeys playfulness is retained throughout life.

It is right and natural that baby should play—something is radically wrong if he does not early show this instinct—but

How Does He Play?

Kicking exercise is the baby's earliest play. From it he derives numerous sensations which give him pleasure. Later this leads on to the discovery of his first and best playthings—his own fingers and toes —best because in addition to their fascinating habit of unexpectedly appearing and disappearing, he derives twofold pleasure from playing with them; that of touching and of being touched. Then he comes into the realms of playthings apart from himself, though not necessarily rattles or playthings proper. Every object within his reach is a potential plaything, and life consists of one great game—the adventure of satisfying curiosity.

This sort of play is utterly satisfying to the unspoilt child, besides being satisfactory and safe. Baby can play it in his own time and at his own pace. When he is tired he can stop; if he goes on a little too long Nature steps in and he sleeps till his nervous energy is restored. His developing faculties are healthily stimulated without the slightest danger of over-stimulation of the delicate nervous system.

The Wrong Sort of Play.

How different is this from the case when the baby is *played with*. Then stimulation is applied in *our* time, at *our* pace, and the result is inevitably a certain degree of over-stimulation, unless the process is kept within strict limits.

Just watch a baby responding to prolonged playing of this kind. The eager, responsive type of child quickly reacts, and his delicious

gurgles and chuckles charm us. If a very little of this is allowed to go a very long way no harm is done, but the first signs of wandering attention or fretfulness are certain signs of fatigue and should be the signal to *stop.* Too often, unfortunately, they are taken as the signal for more strenuous efforts at so-called amusement, to which the baby again responds, though after a time there is probably a slightly hysterical note in his laughter and gleeful shouts. Presently everyone is tired, yet it may strike no one that the baby is fretful and will not sleep for the simple reason that he is nervously exhausted.

Put Yourself in the Baby's Place.

Just imagine one's feelings if a creature of ten times one's size and mental capacity (though not necessarily possessed of intelligence to match) insisted on prolonging certain diverting antics beyond one's powers of spontaneous response! It does not require much effort of the imagination to see that this sort of thing carried on over a long period may mean wrecking of the nervous system with some temperaments. *The bald fact of the matter is that adults play with babies for their own amusement, not the babies' pleasure.*

Someone has suggested that a baby affects many women much as a mechanical toy affects many men. "Give a child a clockwork engine and father won't be able to leave it alone. Give him also a few trucks, a toy railway signal, and 6 feet of tin track and he will neglect his business!" So with many a woman—give her a baby and she can't leave it alone. All unknowingly she satisfies her own play instinct at the expense of the child.

Mothering.

One does not mean to imply for a moment that the baby should receive no attention. Babies allowed to grow up without a certain amount of handling and loving attention become pale, flabby, and listless.

What one does mean is that the greatest part of the direct stimulation should come to the child in the simplest way along with tender and skilful "mothering" and "handling," at feeding and bathing times chiefly. The sum of exercise and stimulation obtained in this way during the course of the day is very considerable and quite sufficient for the young or easily stimulated baby.

A judicious amount of more direct "playing with" may be allowable, according to the type of child, so long as the caution indicated in a previous paragraph is observed. In addition, remember that there is one time when a baby needs no stimulation whatever, and that is just after a meal. Yet, by some contrariness, this is just the time when it is often given, the poor little mite being jogged and patted and talked to.

Troublesome digestive disturbance may be due to this cause, and this alone. A persistent habit of vomiting may be set up which affects progress and requires a prolonged period of treatment for cure. We have many such cases admitted to the Karitane Hospitals, some of whom need practical isolation for a time so over-stimulated are they.

To sum up, the less babies are deliberately played with the better, and there should be no playing near meal times or within an hour or so of bedtime. Injudicious playing with infants makes them nervy and cross, disturbs their sleep, disturbs their digestion, and may cause

undesirable conditions in other respects. If one must play with the baby let the play be of very short duration, stopping short of the first sign of fatigue, gentle and quiet, not boisterous, and not with a whole gallery of spectators looking on and perhaps joining in. The baby's early play should be mainly with his first playmate—himself and his own fingers and toes.

IN THE FARM KITCHEN

BREAD-MAKING.

A GOOD bread-making flour is essential; some flours make excellent cakes and puddings, but are not good for bread-making. This is because bread requires a flour containing plenty of gluten. Some varieties of wheat make a flour low in gluten content, and these are not suitable for bread.

Yeast works best at temperatures of from 77 to 95 deg. Fahr. Keep the dough near the stove in cold weather and during heat waves put in cool place or it will rise too quickly and give a loaf that is too porous. Yeast will not work below 30 deg. Fahr., and is killed at 212 deg. Fahr. Salt retards the action of the yeast slightly; it should not be added till the dough is working well.

A little sugar improves the loaf. It prevents the crust from being too hard. The water or milk used to mix the bread with should be scalded and then allowed to cool down to lukewarm—about 103 deg. Fahr. Milk makes a very nutritious loaf with white crumb and rich crust. If all milk cannot be used try half milk and half water.

Cook for one hour; start with a hot fire (400 deg.) and decrease the temperature after a while. The cooking drives off the carbon dioxide and kills the yeast plant, so that it does not rise any more.

Troubles in Bread-making.

Over kneaded dough is sticky and will not rise; under-kneaded dough is streaky and the bread will contain lumps of dough that have not been worked out.

Too much flour gives too stiff a dough, rises very slowly, and the flavour will be poor.

Too long a rising will give a porous loaf with poor flavour. If the rising continues too long, the bread will settle over the side of the tin or become sour.

Too cool an oven will make the bread rise too long and it will be too porous.

''Rope'' is caused by a bacillus; it often appears in hot, damp weather. When the bread is about a day old the crumb goes stringy or ropey and the flavour is so disagreeable that it is quite unfit for use. This disease is hard to get rid of. The treatment is to sterilise all utensils, and add vinegar equal to 2 per cent. (one tablespoon vinegar to 1½ lb. flour) of the flour used, for all the remaining flour you have.

Recipes for Yeast.

Yeast is a microscopic plant, which, when given food, air, warmth, and moisture multiplies very rapidly and produces carbon dioxide; this stretches the gluten and the dough rises. There are three main kinds of yeast. Compressed yeast comes in small damp cakes; it is ready to work immediately it is given the food and moisture, &c., and will keep in good condition two or three days. Dry yeast is a mass of yeast plants dried and mixed with some kind of meal. Although alive, it is inactive, and even after it has been given the food, warmth, and moisture it takes some hours to start working well. It is sold in tins and will keep some months. Liquid yeast may be made at home as follows:—

Cream of Tartar Yeast.—Put 1 heaped tablespoon of hops in a saucepan with 4 cups water and boil twenty to thirty minutes. Put 1 tablespoon sugar, 1 teaspoon cream of tartar into a basin, strain the boiling hop water on to it and stir; when cold mix with 3 tablespoons flour and add 1 tablespoon old yeast. Put in basin, cover with plate, and keep in a warm place near the stove for twelve to eighteen hours. It is then ready for use. Stand in a cool place, and it will keep for a week or ten days in cool weather. Use three-quarters of a pint of this to make 3 to 5 lb. bread.

Potato Yeast.—Materials: Three potatoes, two pints boiling water, half cup flour, one-quarter teaspoon ginger, one tablespoon sugar, one and a-half tablespoons salt, half cup old yeast. Peel the potatoes, cut small, cook in the boiling water, mash potatoes. Mix next four ingredients and pour over them the potatoes and water in which they have been cooked. When lukewarm add old yeast. Keep lukewarm for twenty-four hours, put into basin, cover, and keep in cool place. Will keep two weeks.

Neither of these yeasts requires bottling or cooking.

TOMATO SOUP.

Materials—2 lb. tomatoes; 2 onions; 2 slices bacon; 1 tablespoonful dripping; 1 tablespoonful sago soaked in 1 cup of water; 1 teaspoonful sugar; 1 teaspoonful salt; 1 pint water; 3 pints stock; pepper.

Utensils—Bowl; knife; saucepan; basin; sieve; wooden spoon.

Method—

1. Wash sago in three waters; soak it in 1 cup of water; wash, peel, and cut up tomatoes and onions.
2. Cut up bacon into small pieces; put dripping and bacon into a saucepan; fry for 3 minutes.
3. Add cut-up vegetables, salt, and sugar; fry for 10 minutes, stirring constantly.
4. Add water; simmer for 1 hour.
5. Strain soup into a bowl, rubbing the thick part through the sieve with a wooden spoon.
6. Return the strained liquid to the saucepan; add stock and soaked sago; boil till the sago is clear; season with pepper and salt as required.

Notes—

1. Tapioca may be used instead of sago.
2. This soup may be made without stock, using 2 quarts of water instead of 1 pint water and 3 pints stock.
3. It may be made with milk, using 3 pints water and 1 pint milk; in this case ¼ teaspoonful of carbonate of soda and the milk are added about 10 minutes before the soup is served.
4. The bacon may be omitted.

FRUIT PIE.

Materials—For pastry: 6 oz. flour; 3 oz. dripping; ½ teaspoonful baking-powder; ½ gill water; salt; 1 dessertspoonful milk for brushing over; 1 teaspoonful sugar for sprinkling over the finished pie. For filling: 1 lb. fruit; water and sugar as required.

Utensils—Pie dish; knife; basin; bowl; pastry board; rolling-pin; teaspoon; fork; brush.

Method—

1. Fill a pie dish with prepared fruit, piling the fruit high in the middle, and adding sufficient water or juice to come to about 1 inch below the inner edge of the dish.
2. Sift flour, baking-powder, and salt into a bowl.
3. Rub dripping into the flour with the tips of the fingers; mix into a dough, adding the water slowly.
4. Turn out on a floured board; knead lightly.
5. Roll out to the thickness of ¼ inch; cut a strip about 1 inch wide, and long enough to cover the edge of the dish; wet the edge, put the strip of pastry on it; wet the upper surface of the pastry.
6. Cover the fruit and the strip of pastry with the remainder of the pastry; cut round the outside edge, working the knife downwards.
7. Ornament the edge with a spoon or fork; decorate with leaves cut out of scraps of pastry.
8. Brush over with milk or water; sprinkle with sugar.
9. Bake in a moderate oven until the pastry is a golden brown colour; this will take at least 30 minutes.

To prepare the fruit—

1. Apples, pears, quinces, and other large firm fruit must be peeled, cored, quartered, and stewed with sugar before they are put into the pie dish.

2. Berries and small fruit should be wiped; they should not be washed. Sugar must be added, the quantity depending on the kind and ripeness of the fruit.
3. Dried fruit should be washed and soaked for 12 hours; sugar and part of the water in which the fruit has been soaked should be added to it in the pie dish.
4. Fruit preserved in water is ready for putting into the pie dish; it may be necessary to keep back part of the juice; the amount of sugar to be added depends on the tartness of the fruit.
5. Tinned fruit preserved in syrup should not require sugar.

DROP SCONES.

Materials—½ lb. flour; 1 teaspoonful carbonate of soda; ½ teaspoonful salt; 2 gills sour milk or butter milk; 1 dessertspoonful sugar.

Utensils—Sieve; bowl; wooden spoon; cup; greased paper; frying-pan.

Method—

Sift flour, carbonate of soda, and salt into a bowl.

2. Add the sugar; mix well; add sour milk or butter milk.
3. Beat the mixture until it is smooth.
4. Rub greased paper over the bottom of a hot frying-pan.
5. Drop small tablespoonfuls of the mixture separately on the hot greased pan.
6. Cook until bubbles appear on the upper side; turn; cook under side until it is golden brown.

Note—If sour milk or butter milk is not obtainable, sweet milk, to which 1 teaspoonful of cream of tartar or ½ teaspoonful tartaric acid has been added, may be used.

STEAK AND KIDNEY PIE—FLAKY PASTRY.

Materials—For filling: 1 lb. steak; 2 sheep's kidneys or ½ ox kidney; 1 slice bacon; 1 tablespoonful flour; 1 teaspoonful salt; ¼ teaspoonful pepper; 1 teaspoonful chopped onion; 1 cup water. For pastry: 6 oz. flour; ½ teaspoonful baking-powder; 1 teaspoonful butter; ½ gill water; 3 oz. lard or dripping.

Utensils—Board; knife; 2 pie dishes; bowl; sieve; rolling-pin; brush.

Method—

1. Cut bacon and kidneys into pieces; slice the meat into strips or squares about ½ an inch thick.
2. Roll all the pieces in flour, pepper, and salt; arrange them in a pie dish, placing a piece of kidney, a piece of kidney suet, and a small piece of bacon on each slice of steak; sprinkle each layer with minced onion.
3. Add water; cover with a second pie dish; cook in a moderate oven for 30 minutes; cover with flaky pastry.

For flaky pastry:

4. Sift flour, baking-powder, and salt into a bowl.
5. Rub in butter with the tips of the fingers; add water slowly; work into a dough.
6. Turn out on a floured board; knead lightly; roll out into a square.
7. Cover the surface with one-third of the lard or dripping broken up into small pieces.
8. Fold in three; place with the open end towards you; roll out, working only from you.
9. Repeat 7 and 8 twice; fold again in three; roll out into the shape of the pie dish.
10. Cut a strip of pastry about ½ an inch wide; moisten the edge of the pie dish; cover the moistened edge with the strip of pastry.
11. Moisten the strip of pastry; place the remainder of the pastry over the pie dish; pressing the edge close to the moistened strip.
12. Trim the edges, cutting with a sharp knife downwards close to the rim of the dish.
13. Make a hole in the middle of the pie; decorate with leaves cut out of the scraps of pastry trimmed from the sides.
14. Brush over with milk or beaten egg; bake in a hot oven for 30 minutes.

PANCAKES.

Materials—2 oz. flour; 1 egg; 1 gill milk; pinch of salt; 1 tablespoonful sugar; 1 lemon.

Utensils—Bowl; sieve; cup; basin; fork; whisk; frying-pan; knife; brown paper; lemon-squeezer; d'oyley; dish.

Method—

1. Sift flour and salt into a bowl.
2. Add beaten yolk of egg and milk; mix well.
3. When smooth add the stiffly-beaten white of egg.
4. Heat dripping in a frying-pan; pour in enough batter to make a very thin layer in the pan.
5. Cook till slightly browned on the lower side; turn quickly; cook for 1 minute on the other side.
6. Lift out; drain on brown paper; roll up; sprinkle with lemon juice and sugar; serve on a d'oyley on a hot dish.

Note—Pancakes may be served piled in layers with jam between each layer; the top pancake is sprinkled with sugar; portions are cut in wedges for serving.

ABERDEEN SAUSAGE.

Materials—1 lb. steak; 2 oz. bacon; ½ cup white bread crubs; 1 tablespoonful flour; 1 tablespoonful sauce; 1 egg; pepper and salt to taste; ½ cup brown bread crumbs.

Utensi's—Mincer; knife; bowl; pudding cloth; saucepan.

Method—

1. Mince the steak and bacon.
2. Put meat, bacon, bread crumbs, pepper, salt, and flour into a mixing bowl.
3. Add sauce and egg; mix thoroughly; form into a sausage.
4. Tie securely in a damp cloth.
5. Place in boiling water and boil for 2 hours.

Roll in bread crumbs and serve cold; garnished with parsley.

GERARD STEAK.

Materials—1 lb. topside steak; 1 dessertspoonful mustard; 1 dessertspoonful sugar; 2 tablespoonfuls vinegar; salt and pepper.

Utensils—Baking dish; basin; iron spoon; board; rolling-pin; cup.

Method—

1. Attend to the oven.
2. Place well-beaten steak in baking dish.
3. Mix together mustard, sugar, flour, salt, and pepper to a soft paste with vinegar.
4. Pour over steak and rub in; allow to stand 1 hour; turn and rub.
5. Add 1 cup of cold water.
6. Place in hot oven and cook for 1 to 1½ hours.
7. Service on hot dish with the gravy.

Note—Onions or tomatoes may be sliced and cooked with the meat.

STUFFED STEAK.

Materials—For forcemeat: 1 cup bread crumbs; 1 small onion; 1 dessertspoonful herbs; 1 dessertspoonful dripping; 1 egg or ¼ cup of milk.

For other: 1 lb. steak; 1 dessertspoonful vinegar; salt; pepper; dripping.

Utensils—Knife; bowl; board; rolling-pin; string; frying-pan, and saucepan or baking tin; cup; wooden spoon; dish; gravy boat.

Method—

For seasoning or forcemeat—

1. Peel and cut up onion finely.
2. Put bread crumbs, onion, herbs, dripping, salt and pepper into a basin; mix well; bind with egg or milk.
3. Beat steak with a rolling-pin; place seasoning on steak; roll up tightly and tie into shape; roll in flour, pepper, and salt.

4. Brown in smoking fat; drain on paper.
5. Put into saucepan; add sufficient boiling water to cover the meat; add vinegar; simmer for 2 hours.
6. Remove meat; thicken gravy with blended flour; add salt and pepper to taste.
7. Return meat to the saucepan; bring to boiling point.
8. Serve on a hot dish; pour some gravy over the meat; serve the remainder in a gravy boat.

Notes—

1. Stuffed steak may be baked; directions for roasting or baking should be followed instead of instructions 5 to 9 given above; gravy should be made as for roast beef.
2. By cutting the meat into slices about 4 inches square and half an inch thick, and placing seasoning or a slice of bacon on each piece, beef olives may be made.
3. Savoury chops may be prepared and cooked similarly.

LANDSCAPE GARDENING.

The landscape gardener must possess a good deal of artistic taste, as he deals with the landscape and its improvement. Should alterations be necessary, they must be carried out in as natural a manner as possible, and they must be in unison with the surrounding country. Any existing natural features may be made the most of.

If trees shut out a desirable view, they may with care be removed. Tree thinning also becomes necessary when some are spoiling others. It is better to have one good specimen than several poor ones. When tree planting, the gardener must look forward, and consider their size when maturity is reached.

Broad stretches of lawn may be broken up with shrubs or specimen trees, or beds of flowers. The character of the soil and the situation must be taken into consideration when planting. It is of no use to plant trees or shrubs that are not likely to succeed, and if doubtful ones are included, they must be in positions where they can be easily replaced should they fail. The character of the dwelling must also be taken into consideration.

Vista making is an important part of landscape gardening, and to carry it out the various points of vantage have to be ascertained and their values determined. The outline of the landscape from the various vantage points must be undulating, not straight or unbroken, and though special hues in greenery may be made the most of, they must not be repeated until the eye wearies of them.

Paths should be as few as possible, and each should be made for some definite purpose. They should run in bold but graceful curves, especially when made of gravel.

If summer houses are included they should not stand out aggressively, and they should be covered with creepers as quickly as possible.

FLOWERING SHRUBS.

Lagerstrœmia indica varieties.—There are many beautiful forms of this shrub on the market, and the finest varieties have been raised in Queensland—*L. Matthewsii* and *L. Earesiana;* the colours of both are lilac, but *Matthewsii* is the darker shade. The heads of bloom of both varieties attained a length of about 24 in., and the individual flowers are a couple of inches across. The plant may be grown in any small garden, and the size may be kept at the will of the gardener. Specimens growing in Brisbane range from a few feet high to 20 ft.

The plant stands severe trimming; in fact, it stands the knife so well that it can be grown almost any height by being cut back in July every year, like a grape vine. One of the finest specimens of *L. Matthewsii* can be seen growing on the river side of the Customs House garden. Plants are easily raised from cuttings taken from the previous year's wood and planted during July and August. Also plants well established may be purchased at any of the nurserymen's stores.

Gardenias.—In the earlier days of Brisbane there were few gardens without a gardenia; now they are rarely seen. *G. Thumbergii* is one of the varieties that should be grown. The flowers are pure white, exquisitely scented, and the foliage of all the varieties are a glossy green. These plants are not too fond of pruning, and should be allowed to grow in their own way. *Gardenia florida* is mostly grown

for florists' use, the flowers being perfect in form and not having the heavy perfume of the other varieties. All the gardenia family are subject to scale diseases, but are easily kept clean by occasional sprayings with boiler water that has plenty of soap in solution. The plants never attain any size, so are very useful in small gardens.

Oleander.—In the northern part of the State these plants flourish, and are much admired by visitors from the Southern States and overseas.

The plants attain a fair size if not kept within bounds. In some of our northern towns it is quite common to see plants 20 to 30 ft. high, and of many colours. The plants are grown in Brisbane, but by a few only; yet they grow just as well here as in the North. The smaller growing varieties should be more extensively grown, and the pink "Carnea," white "Madonna," and carmine "Delphine" are all good old varieties.

When growing the plants in small gardens it is necessary from their earliest stages of growth to keep them well headed back, the young wood of the previous year being the flowering wood.

Lantana.—The small varieties of lantana are not in common with the pest scattered all over Queensland, and are very beautiful when trained as hedges or shrubs. The tangerine-coloured variety and the canary-yellow variety are the two usually grown in Southern Queensland. Splendid specimens of these are growing in the Botanic and Museum gardens. The plants flower for nine months of the year, and will grow in almost any soil and will stand fairly hard conditions.

TRANSPLANTING FRUIT TREES.

The transplanting of partially developed fruit trees is seldom attempted on account of the risk of failure and the trouble entailed in endeavouring to retain sufficient fibrous roots to ensure a reasonable prospect of success. Trees up to five or six years old, where subject to the necessary preliminary treatment, can not only be removed without risk of failure, but transported satisfactorily over long distances. It will be recognised that the sustenance of the plant is absorbed by the small or fibrous roots in the immediate vicinity of their terminals, and by inducing a profusion of these within a short radius of the stem the chances of failure are practically nil. A profusion of small roots may be ensured by cutting through at the desired distance from the stem (15 to 24 inches, according to the size of the tree) all roots to a depth of 18 inches. In so doing a trench is made around the tree, and the end of roots carefully pared if the cutting has not been 'clean.'' The trench is then refilled with soil containing a good supply of humus, and in about three months' time the original root ends will have developed a good supply of fibres. At the time of removal these are not interfered with more than can be avoided, the necessary excavation for removing the tree from its original position and severance of any lower roots being made beyond the terminals of the young root growth. The head of a large tree should be materially shortened at the time of removal. The cutting of roots in the first instance should be performed when the tree is in a domant state; in the case of citrus, conditions are generally favourable about March. Tropical varieties handled in this manner can be removed at almost any time after sufficient roots have formed and hardened, and may be first treated at any time of the year at the period known as "between growths."

FLOWER GARDEN.

All the roses should have been pruned some time ago, but do not forget to look over them occasionally, and encourage them in the way they should go by rubbing off any shoots which tend to grow towards the centre. Where there is a fine young shoot growing in the right direction, cut off the old parent branch which it will replace. If this work is done gradually, it will save a great deal of hacking and sawing when next pruning season arrives. Trim and repair the lawns. Plant out antirrhinums (snapdragons), pansies, hollyhocks, verbenas, petunias, &c. Sow zinnias, amaranthus, balsam, chrysanthemum, marigolds, cosmos, coxcombs, phloxes, sweet peas, lupins; and plant gladiolus, tuber-roses, amaryllis, pancratium, ismene, crinums, belladonna, lily, and other bulbs. In the case of dahlias, however, it will be better to place them in some warm, moist spot, where they will start gently and be ready to plant out in a month or two. It must be remembered that this is the driest of our months. During thirty-eight years the average number of rainy days in August was seven, and the mean average rainfall 2.63 in., and for September 2.07, increasing gradually to a rainfall of 7.69 in. in February.

KITCHEN GARDEN.

Nearly all spring and summer crops can now be planted. Here is a list of seeds and roots to be sown which will keep the market gardeners busy for some time: Carrots, parsnips, turnips, beet, lettuce, endive, salsify, radish, rhubarb, asparagus, Jerusalem artichoke, French beans, runner beans of all kinds, peas, parsley, tomato, egg-plant, sea-kale, cucumber, melon, pumpkin, globe artichokes. Set out any cabbage plants and kohl-rabi that are ready. Towards the end of the month plant out tomatoes, melons, cucumbers, &c., which have been raised under cover. Support peas by sticks or wire netting. Pinch off the tops of broad beans as they come into flower to make the beans set. Plough or dig up old cauliflower and cabbage beds, and let them lie in the rough for a month before replanting, so that the soil may get the benefit of the sun and air. Top-dressing, where vegetables have been planted out with fine stable manure, has a most beneficial effect on their growth, as it furnishes a mulch as well as supplies of plant food.

THE CARE OF THE LAWN.

For a lawn to be a success it must be carefully made in the first place. Good drainage is essential, for stagnant water-logged soil encourages weeds and kills the grass. The soil should be rich in plant food. Give the ground a heavy dressing of good manure, and thoroughly dig it over. Enough time should then be allowed for the soil to settle, as it must be firm when the grass is planted or there will be a series of hills and hollows shortly after. In addition to the manure apply the following mixture at the rate of 3 oz. to the square yard, forking or raking it well into the top spit of the soil:—2 lb. superphosphate of lime, 1 lb. bonemeal, and 1 lb. sulphate of ammonia.

Early in the spring, as the grass begins to grow, a heavy roller should be passed several times over the ground.

Lawns showing bare patches will require a dressing during the autumn, and the mixture previously mentioned will be found very suitable, and will keep the grass well nourished. Wood ashes and soot, combined or not, will also be found beneficial. All dressings should be applied during showery weather. If soil poverty is the cause of a patchy lawn, it is best to rake over in the autumn with a sharp-toothed rake, and dress with a good layer of fine soil and wood ashes.

PLATE 73.

Brisbane's Water Supply—High level filter beds, Mount Crosby.

Orchard Notes for August.

THE COASTAL DISTRICTS.

THE bulk of citrus fruits, with the exception of late ripening varieties, will now have been marketed, and cultural operations, pruning, spraying, &c., should be receiving attention. Where trees show indication of impaired vigour, pruning should be heavy, both in respect of thinning and shortening branches. Where trees are vigorous and healthy a light thinning only will be necessary, except in the case of the Glen Retreat Mandarin, which in coastal lands is invariably disposed to produce a profusion of branches, with consequent over-production and weakening of the constitution of the tree in addition to the fruit being small and not of the best quality. Where white louse is present on the main stem (where it almost invariably makes its first appearance) or branches, spraying with lime sulphur solution in the proportion of one part of the concentrate to ten parts of water after the centre of the tree has been opened up by pruning will be found most beneficial.

In dealing with trees which show signs of failing, investigation should be made near the ground level for indications of collar rot, and in the North Coast district particularly, for the presence of the weevil root-borer which may attack the roots in the vicinity of the thin bases or at some feet distant. A very light application of paradichlor, buried a few inches under the soil in circles around the tree and the surface stamped firm, is considered efficacious in destroying the pest. The distance between the circles (shallow openings connected throughout) should not be more than 18 inches. It may be necessary to repeat the application at three to four weeks' intervals.

Spraying with Bordeaux mixture is desirable as it will, if properly applied, destroy the spores of various fungi later attacking both foliage and fruit.

Where for any reason healthy trees of vigorous constitution are unprofitable they should now be headed back—in fact, the whole of the top removed, leaving only a few selected "arms" of previous branches, all other branches being cut clean away at their base. Three or four main arms, whose length will vary from 2 to 4 feet according to the size of the tree, will form the future head of the tree, and from these numerous shoots will originate; these shoots in turn are reduced according to circumstances, usually from two to five on each arm, and given fair attention they will be in a fit condition to receive selected buds from a prolific tree by next autumn. It is advisable when the shoots intended for budding have attained a length of about 6 inches to nip off their terminals for the purpose of stiffening their growth, otherwise they are liable to be blown off by winds. All branches or parts removed in pruning should be carefully collected and burned. Applications against pests and disease could hardly be satisfactory if the material for reinfestation is available throughout the orchard.

Working the land is essential, and disc implements give best results. Before ploughing it is advisable to apply the necessary fertilizer, not just around the trees beneath the branches, but over the whole orchard, the feeding roots mainly extending beyond the extremities of the branches. The depth to which ploughing should be effected will depend on the nature of the soil and its original preparation. Where the subsoil is of a permeable nature, or has been broken up in the first instance, ploughing could be much deeper than on land where due consideration had not been given to this practice. It will also be noted that among some of our light loams fertility is confined to a shallow depth, where it would be futile to persist in deep ploughing to force the roots into a subsoil from which they could derive but little sustenance. Following upon ploughing, the soil should be further treated until finely broken; the implement necessary will depend upon the constituency of the soil. Generally a good harrow will meet all requirements. On the completion of ploughing between rows an open furrow should not be left on the border or margin, but two or three furrows should be turned back to fill this and the whole then worked sufficiently to leave an even surface throughout the orchard. Except for the purpose of turning in fertilizer or green manure, a good type of disc cultivator can be substituted for the plough and will give at least an equal result.

The planting of trees may be continued and with the exception of custard apples (which should be left until the end of August) should be expedited. The attention of citrus growers should be confined mainly to good varieties like Joppo, Siletta, and late Valencia. The preserving of orange juice will very materially assist in the absorption of our crop, and the fact that the trees develop much more rapidly in this State

than in Southern producing regions is distinctly in our favour; also our fruit contains a much higher sugar content. This, however, is not to be accepted as an invitation to continue the practice of sending immature fruit to the Southern markets.

Grape vines should be pruned, and where cuttings for planting are required these should be selected, trimmed, and heeled in slightly damp soil. Canes intended for cuttings should not be allowed to lie about and dry out, but treated the day they are severed from the plant. Cuttings are frequently made of excessive length. Ten to twelve inches is a fair length, allowing for insertion in the soil to admit of the top bud with a short section of the internode to protrude. Growth is only desired from the upper or exposed bud.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

ALL pruning other than that applied to peaches and varieties which are late in coming into growth should be completed this month, and the planting of young trees, if not already done, should no longer be delayed. Early planting is preferred, the sooner after the fall of leaves the better. The time is opportune (when there is indication of the buds swelling) to work over (where the stock is reasonably vigorous) unprofitable trees. Strap grafting, as advised by the local field officers, is the most satisfactory method of top-working deciduous trees.

The pruning of vines should be postponed as long as circumstances permit, and these can only be gauged on actual observation as they are subject to much variation.

Late spraying against San José scale where present should be applied with an efficient oil emulsion before any growth appears. Each particular brand has its advocates. Where the scale is persistent a 2 per cent. solution of Volck may be applied subsequent to the appearance of foliage. Both of these sprays are efficacious against peach or other aphis at a much reduced strength. One per cent. has given satisfactory results. The usual winter working of the land is essential for the retention of moisture and aeration of the soil, but in shallow soils in which many orchards are planted deep working is most detrimental. The matter of seedling stocks for apples and the inferior plants frequently received from Southern nurseries prompts a query as to how many seeds have been stratified for spring planting, and if any effort is being made towards raising a local supply of nursery stock.

Farm Notes for August.

THE most important work during August will be the preparation of the land for all spring-sown crops. The better the cultivation the better the results that can be expected. Potato planting will be in full swing this month, and in connection with this crop the prevention of fungoid diseases calls for special attention. Where possible, seed potatoes should be selected from localities which are free from disease; they should be well sprouted, and, if possible, should not exceed 2 oz. in weight. Seed potatoes of this size are more economical to use than those large enough to necessitate cutting. However, if only large-sized seed are procurable, the tubers should be cut so that at least two well-developed eyes are left. The cut surfaces require to be well dusted with slaked lime or wood ashes as soon as possible after cutting. If considered necessary to prevent possible infection by fungoid diseases, potatoes should be dipped in a solution of 1 pint of 40 per cent. formalin to 15 gallons of water, leaving them immersed for one hour. The bags used should also be dipped and thoroughly dried. The potatoes should be spread out and dried before rebagging. Where cut tubers are to be sown, they should be dipped before cutting.

In localities where all danger from frosts is over, sweet potato cuttings may be planted out. This crop deserves more atttention owing to its value for both culinary and stock food purposes.

Arrowroot may also be planted this month in suitable localities.

With the advent of warmer weather weed growth will increase, and cultivators will be kept busy in growing crops, and land being prepared for sorghums, millets, maize, cotton, and summer growing crops generally.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF MAY, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING MAY, 1934, AND 1933, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	May.	No. of Years' Records.	May. 1934.	May. 1933.
North Coast.	In.		In.	In.
Atherton	2·10	33	4·19	2·05
Cairns	4·50	52	4·85	4·59
Cardwell	3·61	62	4·06	5·26
Cooktown	2·83	58	2·85	0·95
Herberton	1·68	48	2·66	3·47
Ingham	3·62	42	4·20	6·32
Innisfail	12·24	53	26·34	8·85
Mossman Mill	3·81	21	2·96	4·17
Townsville	1·30	63	0·24	0·48
Central Coast.				
Ayr	1·13	47	0·80	0·61
Bowen	1·32	63	0·37	1·07
Charters Towers	0·79	52	0·97	0·37
Mackay	3·71	63	3·74	1·32
Proserpine	4·33	31	5·39	4·58
St. Lawrence	1·77	63	1·95	0·64
South Coast.				
Biggenden	1·69	35	1·61	0·64
Bundaberg	2·62	51	1·08	0·98
Brisbane	2·78	83	2·39	0·55
Caboolture	2·81	47	2·89	..
Childers	2·09	39	1·92	0·55
Crohamhurst	4·83	41	5·89	0·40
Esk	1·94	47	2·10	0·21
Gayndah	1·55	63	2·41	0·25
Gympie	2·82	64	2·18	0·69
Kilkivan	1·81	55	1·92	0·62
Maryborough	2·99	63	3·24	0·95
Nambour	4·63	38	7·63	1·03
Nanango	1·50	52	2·93	0·26
Rockhampton	1·64	63	0·82	0·47
Woodford	2·85	47	3·94	0·02

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	May.	No. of Years' Records.	May. 1934.	May. 1933.
Central Highlands.	In.		In.	In.
Clermont	1·27	63	2·12	0·44
Gindie	0·91	35	..	..
Springsure	1·25	65	1·08	0·37
Darling Downs.				
Dalby	1·27	64	3·06	0·23
Emu Vale	1·17	38	0·37	0·39
Hermitage	1·21	28	..	0·34
Jimbour	1·17	46	2·95	0·32
Miles	1·46	49	3·16	0·14
Stanthorpe	1·86	61	0·28	1·17
Toowoomba	2·16	62	2·34	0·71
Warwick	1·54	69	0·15	0·42
Maranoa.				
Roma	1·41	60	0·77	0·20
State Farms, &c.				
Bungeworgorai	0·90	20	0·61	0·10
Gatton College	1·52	35	1·30	0·45
Kairi	2·01	20	..	2·82
Mackay Sugar Experiment Station	3·24	37	3·24	1·72

GEORGE G. BOND, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—MAY, 1934.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·93	81	70	84	13, 29	62	10	285	8
Herberton	..	70	57	78	2, 5	43	11	266	14
Rockhampton	30·11	78	60	83	1, 2, 3, 4	54	28	82	6
Brisbane	30·19	72	56	78	1	49	29	239	13
Darling Downs.									
Dalby	30·18	71	46	77	1	35	30	306	8
Stanthorpe	..	65	40	72	13	25	31	28	7
Toowoomba	..	67	47	79	19	35	15	134	7
Mid-Interior.									
Georgetown	29·95	85	62	93	2	48	11	7	2
Longreach	30·10	82	55	89	2	50	9, 31	38	1
Mitchell	30·18	74	44	79	3	35	2, 25, 31	18	3
Western.									
Burketown	29·98	87	66	92	4, 14	55	6	20	2
Boulia	30·08	81	55	88	12	47	9	..	..
Thargomindah	30·18	74	53	80	11	44	31	29	2

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

MOONRISE.

	July, 1934.		August, 1934.		July, 1934.	August, 1934.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	6·45	5·7	6·35	5·21	9·38	11·32
2	6·45	5·7	6·34	5·22	10·40	a.m.
3	6·45	5·7	6·33	5·23	11·41	12·33
4	6·45	5·8	6·32	5·23	a.m.	1·30
5	6·45	5·8	6·32	5·24	12·40	2·27
6	6·45	5·8	6·31	5·24	1·40	3·20
7	6·45	5·9	6·31	5·25	2·39	4·10
8	6·45	5·9	6·30	5·25	3·36	4·55
9	6·44	5·9	6·29	5·26	4·31	5·37
10	6·44	5·10	6·29	5·26	5·24	6·10
11	6·44	5·10	6·28	5·27	6·12	6·42
12	6·44	5·10	6·27	5·27	6·57	7·14
13	6·44	5·11	6·26	5·28	7 35	7·39
14	6·44	5·11	6·25	5·28	8·9	8·9
15	6·44	5·12	6·24	5·29	8·39	8·38
16	6·43	5·12	6·23	5·30	9·10	9·9
17	6·43	5·13	6·22	5·30	9·35	9·47
18	6·43	5·13	6·21	5·31	10·5	10 29
19	6·42	5·14	6·20	5·31	10·36	11·18
						p.m.
20	6·42	5·14	6·19	5·32	11·8	12·17
21	6·41	5·15	6·18	5·32	11·47	1·22
					p.m.	
22	6·41	5·15	6·18	5·32	12·34	2·31
23	6·40	5·16	6·17	5·33	1·30	3·43
24	6·40	5·16	6·16	5·33	2·35	4·54
25	6·39	5·17	6·15	5·34	3·44	6·4
26	6·39	5·17	6·14	5·34	4·55	7·9
27	6·38	5·18	6·13	5·35	6·9	8·14
28	6·38	5·18	6·12	5·35	7·18	9·17
29	6·37	5·19	6.11	5.36	8·24	10·20
30	6·37	5·19	6·10	5·36	9·27	11·22
31	6·36	5·20	6·9	5·37	10·29	..

Phases of the Moon, Occultations, &c.

4 July.	☽ Last Quarter	6 28 a.m.
12 ,,	● New Moon	3 6 a.m.
20 ,,	☾ First Quarter	4 53 a.m.
26 ,,	○ Full Moon	10 9 p.m.

Apogee, 13th July at 4.12 a.m.
Perigee, 26th July at 8.18 p.m.

On the 5th the Earth will be in that part of its orbit most distant from the Sun, at a distance of over 94 million miles. At 11 o'clock at night the Moon will be passing Uranus, which requires binoculars or telescope to be seen. Two days later the Moon will be passing from west to east of Venus which will then be more than 100 million miles from the Earth.

At 5 o'clock in the morning on the 10th the Moon will be passing Mars, 3 degrees northward of it, shortly before they both rise over the eastern horizon. A glimpse of this nearness may be obtained before daylight supervenes.

Mercury will be in inferior conjunction with the Sun on the 11th. As Mercury will be nearly 7 degrees further north than the Sun the planet will not actually pass exactly between the Earth and it.

The interesting spectacle of a partial eclipse of the Moon will be afforded on 26th July. The Moon will begin to dip into the shadow of the Earth at 7.50 p.m., but the eclipse will not become generally noticeable until 8.54 p.m., when a dark notch will begin to grow low down on its north-eastern edge. The Moon, having risen about 5 p.m., will be four hours high and be about 20½ degrees south, 7 degrees N.N.E. (nearly) of the zenith of Brisbane. The dark notch on the Moon will increase till 10.15 p.m., when the Moon will be rather more than half immersed. After this it will gradually decrease until 11.36 p.m., when the Moon will emerge from the darker shadow, but still be in the almost unnoticeable penumbra for an hour and ten minutes longer.

Mercury on the 31st will reach its greatest elongation, 19 degrees west of the Sun, and will rise one hour 12 minutes before it.

Mercury sets at 6.17 p.m., one hour 10 minutes after the Sun on the 1st; on the 15th it rises 34 minutes before the Sun.

Venus rises at 4.4 a.m. on the 1st and at 4.25 a.m. on the 15th.

Mars rises at 5.24 a.m. on the 1st and at 5.11 a.m. on the 15th.

Jupiter rises at 12 noon on the 1st and sets at 12.24 a.m. on the 15th.

Saturn rises at 8.47 p.m. on the 1st and at 7.50 p.m. on the 15th.

2 Aug.	☽ Last Quarter	4 27 p.m.
10 ,,	● New Moon	6 46 p.m.
18 ,,	☾ First Quarter	2 33 p.m.
25 ,,	○ Full Moon	5 37 a.m.

Apogee, 9th August, at 7·12 a.m.
Perigee, 24th August, at 5·48 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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QUEENSLAND AGRICULTURAL JOURNAL

VOL XLII. 1 AUGUST, 1934. PART 2.

Event and Comment.

Progress of the North.

ON his return from Cairns and Townsville, His Excellency the Governor, Sir Leslie Orme Wilson, said that he was impressed more than ever by the progress of the North. On every side there were indications of new development, and the people were looking forward with eager optimism.

At Townsville, he said, he was particularly pleased to have the opportunity of travelling along the Mount Spec road as far as it had been completed. He was taken by rail motor to Mongobulla and thence drove by car 9 miles up the mountain road. The road passed through glorious forest scenery, with wonderful distant views and some delightful wayside beauty spots, such as Saltwater Creek. When completed to the 3,000-feet summit of Mount Spec, the road would give a delightful summer resort to the people of Townsville. To him, however, its great importance lay in the fact that it was proposed to continue the road from the top of Mount Spec into the country beyond, and eventually to link up with Georgetown. When this was done the Gulf people would have another and nearer outlet to the coast. The road would open up valuable mineral country to the west of Townsville.

After opening a fine show at Townsville, the Governor went to Cairns and spent two days touring the Tableland district, which he first visited fourteen months ago. He was glad to have another chance of seeing this great country. He motored up the range road to Yungaburra, and thence to Herberton, Atherton, and Ravenshoe. Unfortunately, rain fell most of the time. The warm welcome he received, however, atoned for the weather's unkindness. On this visit he found that the season had not been very good, because of excessive rain, but, as always, there was a great feeling of optimism among the people.

From Cairns he travelled along the new Cook Highway to Mossman, where he spent a day. This road, like the Mount Spec road, is a fine piece of engineering, and he hoped that it would soon be extended to Cooktown. The scenery is magnificent, and without doubt will attract many tourists, but even without that the road is of the utmost value to the district, as it gives Mossman and Port Douglas direct road communication with Cairns. Mossman, which is as fertile as it is beautiful, is progressing remarkably, said His Excellency, in concluding an interesting comment on his visit to the North.

Britain and Dominion Trade.

SPEAKING at a function arranged in his honour by the Glasgow Chamber of Commerce, at Glasgow, on 18th June, the Premier of Queensland, Hon. W. Forgan Smith, said he felt positive that there was a definite public opinion among all people in Great Britain in favour of very close relations within the British Commonwealth of Nations. That was a very good thing, and spoke well for the future.

"It is important" he added, "that this unity within the Commonwealth should be made stronger and stronger as the years go on, because I believe that we have a mission to perform, that the world requires a lead in the interests of civilisation itself, and there is no organisation in the world to-day which could more effectively give that lead than the British Commonwealth of Nations."

On the question of trade, Mr. Smith said it had been suggested to them that their competition with the British farmer was reacting detrimentally to British interests. It had been suggested that Australian produce should be limited, and that they should be subject to quotas.

They in Australia were perturbed about such proposals, because they were contrary to the aim and purpose of the Australian people. First of all, they regarded them as bad economics.

He pointed out that in Australia there were hundreds of thousands of acres that were yet awaiting development. "In these circumstances," he added, "for us to agree to any policy of restriction would mean that we agreed to arrested development, that the unemployed should have no opportunity of getting work, and, more tragic than anything, that boys leaving school would not be absorbed into useful industry.

"We cannot agree to these things. We desire increased production, increased settlement, and increased developmnt of our own country. Furthermore, it must be realised that Australia is a debtor country. We must, therefore, meet our obligations in the form of export produce."

They were very proud of the fact, he observed, that Australia had met all its obligations on the due date. They were determined to continue to do so, but they must have the capacity to produce and the right to sell.

Dealing with the export of meat from Australia, Mr. Smith said it had been stated that such competition was detrimental to the growers of beef and mutton in Great Britain. Such was not the case. Australia competed not with the British farmer but with foreign countries. Britain definitely imported more from foreign countries than from the Dominions and Crown colonies, so that their competition in British markets was not with the British farmer but with the producers in foreign countries.

When they talked of trade within the Empire they in Australia were not asking for anything they were not prepared themselves to give. Their imports from Britain were increasing rapidly as the result of the Ottawa Conference.

Restriction of Exports.

ADDRESSING a large gathering of producers at Nambour last month, the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, said that the question of the limitation of production about which they had heard so much recently, transcended party politics, and it was a matter associated intimately with the well-being of the nation. In recent conferences with which he had been associated he had not heard the term, restriction of production used. The term restriction of exports had been used, and it implied a relation to practically every commodity upon which the country had built up its national solvency. It had been said that if they restricted they would get higher prices for the commodity which they exported. But experience did not indicate that such was a fact. Last year butter exports were restricted for a certain period, and it was held that the price would be enhanced on the London market. In consequence of withholding certain supplies Queensland was harder hit than any of the other States of the Commonwealth at that time, because substantial charges in commission and storage had to be met. At that very time there was a fall on the London market, therefore there was little encouragement to believe that by holding back supplies they would obtain enhanced prices.

The time had gone when Australia could regard itself as an entity sufficient unto herself. Queensland was but one part of an economic whole, and the whole basis of the question was what was termed economic nationalism. That policy, however, could not, in his opinion, be sustained in the final analysis. Some countries were already feeling the burden of that policy and were preferring to go back to the old system of producing what they could economically and purchasing abroad what they could afford and what could not be produced economically at home. Theories of economics which were acceptable to one generation were not acceptable in another. If any truth had been brought home poignantly it was the interdependence of one nation upon another.

Queensland Citrus Scale Insects and their Control.

By W. A. T. SUMMERVILLE, M.Sc., Assistant Entomologist.

(Continued from page 33.)

CONTROL OF INDIVIDUAL SPECIES OF SCALE INSECTS.

ALTHOUGH, as has been pointed out, scale insects, as a rule, occur in mixed populations, at times the control work can be confined to one species. Further, in order to understand fully the recommendations for combating complexities, it is necessary for growers to know how to control each species separately. For these reasons growers should study the following paragraphs dealing with each species.

Red Scale.

In so far as the coastal districts of the State are concerned, except in isolated places where the topography of the country exerts sufficient influence to cause materially higher temperature and perhaps lower rainfall than normally exists in coastal areas, red scale should occur as a serious pest only in abnormally dry times on trees other than lemons. If, therefore, in these districts a tree of any variety other than lemon be persistently heavily attacked by that scale, the true cause of the trouble is to be sought in some other factor affecting the health of the tree. Under some circumstances it is useless endeavouring to control the red scale satisfactorily until the health of the tree is improved. In most coastal areas, therefore, the first step in combating this scale is to examine the tree thoroughly for other trouble. Probably the two commonest injurious agents in this connection are the root bark channeller, *Pseudomydaus citriperda* Tryon and melanose, *Phomopsis citri*, and more often than anything else poor cultural conditions. In many cases all that is required to reduce the red scale infestation to insignificance is the use of fertilizer coupled with improved methods of cultivation. Active control measures, as described below, will, of course, accompany such operations to a certain extent, at least in the first instance.

In districts where the insect is a pest of otherwise healthy trees, fumigation should be practised where possible. Both the resin-soda-fish oil mixture and the oil sprays are also effective, and though not so efficient may be substituted for fumigation.

Seasonal life history studies show that there is no period of the year, except, perhaps, in winter, when reproduction is not in progress. Unfortunately, the winter is not a very good time to combat the pest. Red scale, though dead, may remain on the fruit for a considerable time unless appreciable expansion of the rind takes place, and thus, if the control be established too late, brushing of the fruit may still be necessary. Naturally, the dead scales are more easily removed than the living, but brushing is undesirable for other reasons. Further, early fruit, particularly mandarins and navels, are harvested very early in

the winter or even before the really cold weather begins, and thus the fruit on such trees would often be removed before control operations began. To the small grower with trees of early, mid-season, and late fruit, winter fumigation would cause much inconvenience, owing to its coinciding with harvesting and other operations, and would necessitate additional labour costs. Thus, though winter fumigation is effective and safe, it cannot be recommended for general use. The resin-soda-fish oil spray may be used in winter control work, but oil sprays should not be employed then.

By far the best period to establish control of red scale is between early March and the middle of April. If a good kill be obtained at this time the trees under normal circumstances will remain commercially free of the scale until January of the following year. During January the populations will perhaps be again built up considerably, and this sometimes leads orchardists into endeavouring to control the scale in that month. However, it is during the driest times that the red scale becomes most troublesome, and usually spraying cannot be carried out in January owing to the weather conditions. Fumigation may often be carried out at such times, but it must be remembered that the pest has still to pass through a period of prolific reproduction and therefore the establishment of a lasting control is not assured no matter how good the kill obtained. February is similar to January until the monsoonal rains commence, and from then until the rains cease pest control work cannot be undertaken. After the rains have finished a little time must be allowed to elapse to enable the recent growth to harden, otherwise this may be checked by the scalicide. As soon as conditions permit of the control work the colonies should be examined for parasites and the likelihood of any large hatch. Then, provided parasitation does not render artificial control unnecessary, the application should be timed to operate against the scales when there is a predominance of young, should such occur. The work should be allowed to wait as long as possible as the nearer it is done to the winter the more lasting the control will be. It must be remembered that six weeks will probably elapse between the time the scale is killed and when it will fall from the fruit, and also that if oil be used late this will interfere with the artificial colouring of early fruit.

This recommendation is based on the assumption that monsoonal rain will fall during February and March. If the dry season be protracted abnormally it may be that the scale position will become acute before the best period for control as outlined above arrives. Such a situation however is likely to occur only in the more inland parts. In many such districts irrigation is carried out, and a good deal can be done towards relieving the position by using plenty of water. It has been shown experimentally at Gayndah that by the use of water heavily-infested trees can be kept in fair condition for a considerable time longer than would otherwise be possible. If, therefore, orchardists find that the red scale is becoming a menace very much earlier than it is desirable to carry out control, steps must be taken to ensure the trees as good conditions as possible. It must be remembered that it is in these particularly dry seasons that red scale is most prolific, and therefore the

establishment of lasting control at such times by early work is considerably more unlikely. It is in such seasons as this that the larger horned citrus bug, *Biprorulus bibax* Breddin will most likely be in evidence, and in such circumstances reference should be made to the recommendations for the control of this complex of pests as given in connection with notes on the Rockhampton district.

In far-western areas it may at times be inadvisable to allow red scale to breed uninterruptedly for twelve months. This will be the case particularly when the winter is very mild or of but short duration. In such cases observation should be made on the trees during November, as otherwise the position may not be apparent until well into December, and control at such a time in these parts is only accomplished with great risk to the trees. If early summer control be established, it may happen that the trees remain fairly clean for several months with the result that the late summer-autumn period control is allowed to pass. This will mean that control will probably be again necessary in the early summer. In this way the main control period may become fixed for early summer. Control at this season is definitely less satisfactory than at the time recommended for general use, and, therefore, care should be taken to guard against this happening. It is necessary in such cases to examine the twigs and small branches and not be guided solely by the fruit infestation.

When two treatments in one year are necessary, only one should be an oil spray. Any other combination of scalicides will be more satisfactory than two oil sprayings. If oil and hydrocyanic acid are to be used it is generally found more satisfactory to use the fumigant for the first treatment.

The foregoing remarks apply essentially to older trees. Young trees may be attacked in any district. Trees purchased from a nursery and found to be heavily infested with red scale should not be accepted, as control of the scale is frequently obtained only at too great expense to the health of young trees. Any young tree, however, may carry a few red scale individuals, and these do not matter greatly and with most varieties other than lemons, and perhaps grapefruit, it will be found that these light infestations are thrown off naturally soon after the trees become established. Light oil sprayings may be used on young trees once these have become established, but even with these fumigation is preferable to all other treatments.

In general, red scale control operations in this State have previously been carried out mainly in November or thereabout. The recent investigations however have demonstrated that much better results are to be obtained by working during the late summer and autumn and that at such times the risk of injury to the trees is greatly lessened.

Circular Black Scale.

It will be seen from what has been recorded of the seasonal life history that young of circular black scale will ordinarily predominate in September, November, January, and March. Fumigation or spraying in September cannot be recommended owing to the possibility of injury to the tree, and January is normally too hot and too dry to permit of

control work being recommended for the districts in which this species is a pest. November and March, then, become the only periods in which control operations can be advised. Of the two March, or perhaps April, according to weather conditions, is preferred for the following reasons:—(1) In November the risk of injuring the tree, though not great, is still greater than in the late summer or autumn. (2) As has been mentioned in connection with the habits of the pest, the greatest objection to the scale is that it disfigures the fruit. The individuals do not migrate to the fruit to any extent until the late summer, and at this time a big proportion of the emerging young settle down on the fruit. Thus even if a good kill be obtained in November a period of great reproductivity has still to be passed through, and it is possible that before the fruit is harvested the fruit may carry an infestation. It is even possible that the whole tree may be again infested before the winter. It must be remembered that circular black is not a particularly injurious scale on the tree, so that the extra damage done by leaving the trees infested for somewhat longer than may be absolutely necessary will not matter greatly. (3) Breeding in the winter is at a standstill for all practical purposes and thus good control established in March or April ensures a low scale population for a longer period than at any other time of the year. (4) Circular black is commonly associated with red scale, and as the same scalicides are effective against both species it is advantageous to make one application suffice for both pests if possible. (5) A most important natural enemy of this scale commonly builds up a population during the summer months, and early in March it is commonly possible to assess the amount of scale which can be anticipated at harvesting time. This in itself if often of importance, for this enemy, *Catoblemna dubia* Butl., quite frequently removes heavy infestations of the pest and thus eliminates the necessity for artificial control.

It is recommended therefore that, though the late summer brood is rather more uneven than any other, control measures against circular black scale should be applied in March or thereabouts according to the time of emergence of the late summer brood. On the leaves circular black scale is not particularly difficult to kill, but the adult females on the fruit at the time of reproduction adhere very tightly to the rind and are thus more difficult to reach with sprays. It is therefore advisable to apply sprays at a time when the minimum possible number of females are reproducing. This means waiting until the fourth hatch is completed or as near that time as possible. If, as commonly happens, the red scale and circular black are associated, the time of application will usually be decided by the requirements for the dominant species but reproducing circular black on the fruit is less susceptible to sprays than is the red, and this point must be borne in mind.

As has been indicated fumigation, or spraying with oil or the resin-soda-fish oil mixture, may be employed against this species.

Mussel Scale.

Mussel scale is one of the most difficult citrus scale insects to control satisfactorily and orchardists should not neglect any appreciable infestations. It has been pointed out that lack of vigour is an important

factor predisposing the tree to heavy infestation, and the first recommendation therefore is to attend to the health of the plant. In this connection reference should be made to the remarks made in the discussion on the control of red scale. In the case of mussel scale, the bronze orange bug, *Rhœcocoris sulciventris* Stol., is a further important accessory to infestation and of most importance is the succession of mussel scale following injury by pink wax.

When good, vigorous trees are attacked the infestation is usually wholly confined to the fruit, and care must be taken to examine these in the early months of the year paying particular attention to the points of contact and the stem ends.

On account of the continuity of breeding no specific time can be given when young will probably predominate. At the same time, in the majority of orchards control operations can be timed to coincide with a large hatch of young and observations should always be made to ensure this if at all possible. As has been mentioned in connection with the life history, there is sometimes an approach to a pure brood during the latter part of February and, provided control operations are not delayed too long by rain, use may be made of such an occurrence. As the scales usually infest the fruit only after the middle of summer, it is towards the end of that season or in autumn that control generally is most desirable and in so far as healthy trees are concerned this is invariably the best time to combat the pest. On other trees any opportunity offered by suitable conditions of breeding and the state of the trees should be taken. In general, however, it will be found that late summer or autumn work will be attended by the best results in all cases.

Fumigation is most effective and should be employed where practicable. Spraying with straight oil cannot be recommended as certain to give commercial control against the heaviest infestations unless young predominate to the practical exclusion of other stages. Excellent results in all experimental work were obtained with the resin-soda-fish oil spray and this mixture can be recommended against even the heaviest infestations. Against light infestations, particularly when pink wax must be combated at the same time, the combination of soap and washing soda with oil may be used with success. This combination, though not so effective as the resin-soda-fish oil mixture, is considerably superior to straight oil.

White Louse.

This scale is very susceptible to hydrocyanic acid gas and control of the pest can be established at any time when fumigation is practicable. The white louse is also effectively combated with lime sulphur, and for reasons arising out of the use of these two scalicides at various times the control of the pest is generally best accomplished by the use of the spray. The best practice is to use lime sulphur in the late winter just before blossoming time at a strength of 1 to 12. By using the spray at this time a single application rids the tree of white louse before the new season growth appears and at the same time many other bark troubles are brought under control.

Whilst both lime sulphur and hydrocyanic acid gas are effective at almost any time against this scale insect the careful orchardist will always examine the colony to make sure that he is not operating just prior to an extensive egg hatch or that natural enemies, particularly the predatory moth *C. dubia,* are not present in large numbers—the latter a by no means rare occurrence late in the summer.

The resin-soda-fish oil mixture is also very effective against this pest.

Hemispherical Scale.

Due to a great extent to the activity of natural enemies it is seldom necessary to apply artificial control measures against the hemispherical scale. Before applying such measures it is always advisable to examine the colonies and learn to what extent parasites are present. It will generally be found that by the time the population of this scale is so large that the necessity for control measures is suggested, parasitism is so high that the infestation will soon be reduced to insignificance.

When exceptionally heavy infestations do occur these are never in evidence before January, and though November spraying may be carried out this is not likely to be of any practical value. January work cannot be recommended owing to the probability of adverse weather conditions. In general then the opportunities offered by the occurrence of young in March and April should be taken when artificial control is necessary. If spraying be delayed until the dormant season is very close, the resin-soda-fish oil mixture should be used, but if March work be possible either this mixture or oil may be used. The oil-lime sulphur combination should generally be more useful than straight oil, owing to the possible need for control of red spider or Maori at this time. Fumigation is effective, but hemispherical scale reaches its maximum and indeed only economic importance in those districts where fumigation cannot be satisfactorily used.

Olive Scale.

In no case has this insect been found in sufficient numbers in Queensland to cause the slightest concern, and it is most unlikely that artificial control of the species will be required. No experimental control work has been possible, and, in the circumstances, no definite recommendations can be made. It is probable that the recommendations made for hemispherical scale as above would give satisfactory results against olive scale.

Soft Brown Scale.

In no instance has this scale been seen on citrus in this State in appreciable numbers, and the small colonies which do occur are always confined to at most a few twigs on one or two trees in the orchard. Even in these the percentage parasitised is almost always very high and control by artificial means is thus not called for in any case. All that need be done in any case is to remove those twigs which carry colonies as soon as they are noticed. Fumigation and oil sprays have been found effective against this species in other countries.

Long Soft Scale.

When artificial control of this species is desired, either fumigation or oil spraying may be employed. Though the adults are rather soft bodied they appear to be rather more resistant to oil than might be expected and therefore control operations should be directed against the youngest stage possible. As the seasonal life history is not definitely known, the best time for applying control measures cannot be stated; but from experimental work it appears that late summer-autumn applications will give quite satisfactory results. As the scale is commonly accompanied by a growth of sooty mould control at this time is usually more desirable than at any other season.

Flat Scale.

With this species also artificial control measures have not so far been required and no experimental work has been done on this point. It is probable, however, that fumigation or oil spraying when the young are dominant would effectively control the insect.

Pulvinaria Scale.

Pulvinaria is not a difficult pest to control. Fumigation cannot be recommended in those districts in which the pest is of importance, but both oil and the resin-soda-fish oil mixture are effective. Of the two sprays the latter is to be preferred in general, on account of the fact that the control of the scale insect and the bronze orange bug can be effected concurrently by the use of this material and the two pests are commonly associated. The spray is effective against the scales many weeks old and generally the application can be made at the time most opportune for the control of the bug. Apart from this the mixture is more efficient against the scale insect than is the straight oil.

It is very fortunate that the females of Pulvinaria scale move from the twigs to the leaves to produce the large white ovisacs and thus become very conspicuous at this time. The most important point to be observed is that spraying must not be done too early. It is essential that the hatchings be complete and it will be noted that young do not emerge for upwards of a fortnight after the ovisac formation. It is the defunct ovisacs or their remains which must be looked for and not those full of eggs.

Where no other pest is to be considered control operations will be commenced as early as possible and in such cases, as the scale is often confined to but a portion of the tree and sometimes to only a limited number of trees, spot spraying may be profitably employed.

Pink Wax.

There is no other citrus scale insect in the State against which so much unsatisfactory work is done as pink wax. Failures are generally due to neglecting to give full consideration to the seasonal life history and habits of the pest.

From what has been recorded in earlier paragraphs it will be seen that there are two periods each year when young may be expected to occur either as the progeny of individuals already in the orchard or as

migrants from outside sources. As the outside sources are very extensive, control operations must be delayed until all the young which are going to arrive in the orchard have done so. The time of reproductivity in both orchards and natural forest will generally be found to practically coincide except where some factor such as irrigation enters. In most cases then the emergence need only be observed on orchard trees. However, as the outside breeding grounds are usually easily and quickly accessible it might always be advisable to carry out inspections of these sources. As has been recorded egg hatching is normally spread over a period of about one month. During this time the young grow to about the size of the head of an ordinary pin or a little larger. Thus by spraying when the typical young are about that size further infestation is unlikely to occur. The soap and washing soda spray is effective against young up to that size, but the efficiency quickly drops from that time onwards and therefore the application must not be too long delayed if good results are to be obtained. At times, owing probably to unusual weather conditions, the breeding is rather protracted, with the result that a big proportion of the first hatched young reach the size given above before reproduction is nearly finished. In such times as these the procedure will be dictated by the degree of infestation. If the number of females left to reproduce is rather small when the ordinary correct time of application is at hand, these may be ignored though, of course, this lowers the standard of control. If on the other hand the numbers are about equally divided it may be necessary to substitute the resin-soda-fish oil spray for the soap and washing soda and spray as late as possible without allowing too big a proportion of the young to grow to twice the size indicated above. The first-mentioned mixture is effective up to that time, but neither washing soda wash nor the soap and washing soda spray can be recommended against individuals appreciably larger than the head of a pin. The essential observations then are the size of the young together with the proportion of adult females which are reproducing. Each of these must be observed, otherwise confusing data will be obtained.

The times of appearance of the young vary considerably and the time of application of the scalicide may be in November or early December for the early summer generation and from late February to late April for the late summer brood.

In addition to the sprays given above hydrocyanic acid gas may be employed for the control of pink wax. When generated by the pot method the results are quite satisfactory and fumigation by this method can be recommended against the heaviest infestations of this pest. When calcium cyanide is employed the results are not so satisfactory and against very heavy infestations the sprays are superior. However, against ordinary or light colonies calcium cyanide fumigation is quite efficient.

White Wax.

It is very seldom necessary to apply artificial means of control against white wax in Queensland. The scale is usually confined to but a few branches on a few trees, and generally the entire colony can be removed and burned with the infested branch. With more general infestations however, spraying must be resorted to and when this is the case it is necessary to operate against the young as far as possible.

From the work done on the life history it appears that the period of control may occur any time between late January and the end of March, or perhaps even later. As with pink wax it is essential that the hatching be completed before the control measure be applied.

Soap and washing soda spray is effective only against the very young individuals and cannot be recommended against those which are at all well grown. The washing soda wash and the resin-soda-fish oil spray were both found satisfactory, and of the two the latter gave the best results in experimental work.

Cottony Cushion Scale and Mealy Bug.

Artificial control of either cottony cushion scale or the mealy bug is rarely called for in this State. Where large colonies of either occur it is generally due to the temporary absence of important natural enemies, particularly the ladybird *Cryptolœmus montrouzieri.* When the population of either species of coccid is observed to be increasing unduly a colony of the useful insect should be obtained. Generally in western areas the ladybird is common on prickly-pear where it finds another mealy bug to prey upon, whilst in coastal districts it is frequently to be found in large numbers on the bunya pine, *Auracaria bidwillii,* on which tree it is feeding on another species of coccid. Often, too, it may be absent from one orchard and be present in large numbers on a second only a few miles away. Growers then can most frequently supply the deficiency for themselves. The ladybirds should be given careful treatment, and if being transported in the larval or adult stage should be provided with a supply of mealy bugs or scale insects to avoid starvation. Fumigation or the resin-soda-fish oil may be employed if artificial control be desired.

SCALE INSECT CONTROL IN VARIOUS DISTRICTS WITH PARTICULAR REFERENCE TO COMPLEXES WITH OTHER PESTS AND DISEASES.

It is comparatively seldom that the problem of scale control is a matter concerning one species of scale only. In by far the greatest number of cases the grower requires to combat mixed populations of these parts. Furthermore, the occurrence of another pest or a disease may mean that it is either necessary or at least economical to vary the scale treatment from the one which would be used to combat the scale alone. Thus the value of simple recommendations for the control of individual species is rather limited. Table VI. shows, for the various districts, the complexes, which include scale insects. The manner in which the situations arising out of these mixed populations of pests can be best dealt with is outlined in later paragraphs. Variations from what has been given as the normal for each district may be found, and it is possible that the position on any one orchard will be more closely allied to what has been described for trees in other localities. It may therefore be advisable to peruse the notes on districts other than the one in which the orchard is situated. Apart from the more typical complications many others are to be found which cannot be included, but growers should be able to solve many of the problems for themselves after studying the manner in which parallel ones are attacked.

TABLE VI.

District.	Dominant Scale.	Pest or Disease likely to cause Modification of Treatment.		Other Scales of Importance.
		Pest.	Disease.	
Tamborine Mt. ..	Mussel	Red Scale Bronze Orange Bug	Melanose	
Redland Bay-Cleveland	Pink Wax	Mussel Scale Bronze Orange Bug Maori	Melanose	White Louse
	Red	Maori		
Brisbane to Landsborough	Pink Wax	Bronze Orange Bug Mussel Scale	Scab Melanose	White Louse
	Red	Larger Horned Citrus Bug	Scab Melanose	
Palmwoods, Woombye, Nambour	Pink Wax	Mussel Scale Pulvinaria Scale Bronze Orange Bug	Melanose Black Spot Scab Fly Speck	White Louse
	Red	Larger Horned Citrus Bug Pink Wax	Black Spot Scab Melanose	
Buderim Mt.	Pink Wax	Mussel Scale Bronze Orange Bug Red Scale	Melanose Black Spot	
Blackall Range ..	Mussel Pulvinaria	Bronze Orange Bug	Melanose Black Spot Fly Speck Scab	Pink Wax
Yandina to Gympie ..	Pink Wax	Mussel Scale Bronze Orange Bug	Melanose Scab	White Louse
	Red		Scab	
Burrum	Pink Wax	Mussel Scale Red Scale	Black Spot Emperor Brown Spot	White Louse
Rockhampton ..	Red	Circular Black Scale Mussel Scale Larger Horned Citrus Bug	Black Spot Scab	White Louse Long Soft Scale
	Pink Wax	Mussel Scale	Black Spot	
Yeppoon	Pink Wax	Mussel Scale Red Scale	Melanose	Long Soft Scale
Byfield..	Pink Wax	Mussel Scale	Melanose Fly Speck	
Gayndah	Red	Circular Black Scale Larger Horned Citrus Bug Pink Wax	Black Spot Scab	White Louse
Lockyer	Pink Wax	Mussel Scale	Melanose	White Louse
	Red	Circular Black Scale	Melanose	
Esk	Pink Wax	Circular Black Scale Red Scale	Melanose	White Louse
Roma and Far West..	Red	Larger Horned Citrus Bug Circular Black Scale		White Louse

Tamborine Mountain.

Mussel scale is the most commonly found species in the Tamborine district, whilst red scale and pink wax are also fairly abundant. A little hemispherical scale is also to be found at times. That mussel and red scales are of such importance in this district is due in part to the lack of vigour of many trees. As has been pointed out lack of vigour is an

important predisposing factor with each of these species. The reasons for the condition of the trees are purely cultural for the most part and cannot be discussed here. It must be pointed out, however, that very few growers appear to realise fully the ill-effects of constant winds on citrus trees. In so far as the scale position is concerned, there are two main effects of these winds. In the first place, natural enemies, particularly entomogenous fungi such as *Spaerostilbe coccophila,* are much more active in protected places than where the trees are exposed to constant dessicating winds and this is undoubtedly a contributing factor in many instances. However, the greatest cause of heavy scale population in this district is to be looked for mainly in the action of the winds on the trees themselves, and the provision of windbreaks will certainly improve the position with respect to the dominant scale species quite apart from the consequent increase in natural control. Consideration should be given to the provision of windbreaks, and, above all, it is essential that existing natural windbreaks should be preserved as far as possible. Melanose and pests which impair the vigour of the trees also contribute in some orchards to the unsatisfactory scale position. If the health of the trees be given proper attention it will be found that the only artificial control measure which need be applied against the scale insects at Tamborine Mountain is the use of the resin-soda-fish oil spray as recommended for combating the bronze orange bug.

Redland Bay-Cleveland District.

In the Redland Bay-Cleveland district there are two distinct types of scale infestation to be found. For the most part only one type is present on each orchard, but in some cases both types may be present on different trees in the one orchard and on occasions the types are merged. The first type, which is generally the most severe but which is the less common, has red scale as the dominant species. Mussel scale may be present and the trees commonly carry a good deal of white louse. This association is brought about to a large degree by the subnormal vigour of the trees and is consequently mostly in evidence on orchards on weaker soils or in exposed positions. Exposure to strong winds is a definite factor in the health of many of the trees in this district, and for the most part elimination or considerable reduction in the influence of these by the provision of windbreaks will accomplish much towards the control of these scale pests. In other parts cultural conditions need attention, and for the most part in these cases it appears that nitrogen deficiency of the soils should be made good as a first step towards the commercial control of this type of scale insect association. Owing to the breeding grounds provided by trees such as those mentioned above, these scale insects may spread to nearby healthy trees to a small extent, and it is on such trees that the two types of infestation may merge as mentioned above. Where possible it is obviously of first importance to reduce the breeding grounds and to correct predisposing factors, and artificial control must be considered of secondary importance for the most part where this type of scale population predominates. Where conditions are such that commercial control is possible by purely artificial methods, oil or the oil-soap-washing soda combination will give beneficial results if applied in accordance with the requirements of the dominant species. If Maori be abundant during the control period the oil-lime sulphur combination may be used if the temperatures are not excessive. The resin-soda-fish oil mixture will very often give the most lasting beneficial results, particularly where the mussel scale is heavy.

The second type of infestation is one in which pink wax is predominant, at least in the first place, and in which mussel scale is an important factor. White louse may also occur on these trees but is generally less evident than with trees affected by the first-mentioned scale complex. Pulvinaria scale is commonly found but usually in small infestations on any one tree. The trees carrying this pink wax mussel scale complex are, for the most part, the more vigorous ones and consequently the bronze orange bug may also be present. Melanose may be found on these trees, but usually it gives concern only in so far as it causes blemishes on the fruit. With this type of association the mussel scale is generally of importance only as a pest of the fruit, but if the trees be neglected for any length of time this scale may become more and more important until finally pink wax becomes of little moment and the twig and branch infestation by the mussel scale assumes major significance.

In so far as this type of association is concerned the use of soap and washing soda in the early summer as required for the control of pink wax, followed in the late summer or autumn by a thorough spraying with the resin-soda-fish oil mixture is to be recommended. If the pink wax be very prevalent the second application should be timed as required for the control of that pest, but if the bronze orange bug be of more importance the resin-soda-fish oil spraying should be applied as recommended for the control of that species, and this in general will suffice for the control of both scales and bug. In abnormal cases it may be necessary to establish special control of the pink wax earlier and then the soap and washing soda spray should be applied. This, however, will rarely be required. If the melanose is to be combated it may be necessary to use the combination of Burgundy-soap and washing soda in place of straight soap and washing soda in the early summer. If the bronze orange bug is not to be considered at all oil-soap-washing soda may be substituted for the resin-soda-fish oil spray, but this is not to be generally advised.

Brisbane to Landsborough.

From Brisbane to Landsborough orchards are for the most part small isolated areas, and consequently conditions change greatly from orchard to orchard. Much of what has been written concerning the Redland Bay-Cleveland district applies to this area also. There are, however, a few places in which, owing to purely local conditions, red scale becomes a pest of fairly vigorous trees. A proportion of the orchards in this district are situated on unsuitable soil, however, and this is more often a factor in red scale incidence than is climate. Bronze orange bug occurs throughout the area, but as handpicking suffices for the control of this pest in most cases in the area under consideration, this does not often affect the control measures to be adopted against the scale insects. For the greater portion of the area the measures recommended for the control of individual species may be adopted, and as conditions often permit of the use of hydrocyanic acid gas fumigation is valuable. Where fumigation is not practicable spraying with oil or, if Maori be abundant, the oil-lime sulphur combination may be used except where pink wax predominates. Against pink wax either the soap and washing soda spray or resin-soda-fish oil may be employed in accordance with the requirements for this species. Pulvinaria and white wax are also to be found in places, generally associated with pink wax, and in such cases the resin-soda-fish oil must be used in the late summer

and the use of soap and washing soda mixture confined to the early summer for the control of the pink wax. Scab disease is common on lemons and mandarins in this area, and if this disease is to be combated the Burgundy-soap and washing soda combination may then be substituted for the early summer application of soap and washing soda, and the resin-soda-fish oil spray should then certainly be used in the late summer-autumn period.

Palmwoods—Woombye—Nambour.

On healthy, free-growing trees, other than lemons and to a lesser extent grapefruit, in these districts, pink wax is invariably the outstanding scale pest. Mussel scale is also commonly found, but if the orchard be well tended this species is usually confined to the fruit in pest proportions. Where concurrent control of these pests is desired the resin-soda-fish oil mixture should be employed. The time of application will ordinarily be dictated by the requirements for the control of pink wax. It will generally be necessary to use soap and washing soda in the early summer for the control of that brood of the pink wax. The presence of scab, particulauly on Beauty of Glen Retreat mandarin trees, may necessitate the use of the Burgundy-soap and washing soda combination in the early summer, but this is unlikely, as usually the time of application of the fungicide will not coincide with that for the scalicide. Melanose and black spot are also prevalent in the district, and if for any reason the continued used of Bordeaux or Burgundy is required the resin-soda-fish oil spray should be used for the control of all scale species. The time of application of this spray will usually be in conformity with the requirements for the dominant scale species, but at times the bronze orange bug may be prevalent and this may necessitate some change. Except where pink wax is the important scale pest this will not matter greatly, for the spray will give quite good results against all other scale pests if applied at the time required for the control of the bug. If the pink wax be very heavy and the period of control far removed from the time of application for the bug, it may be necessary to use soap and washing soda in addition to the resin spray, but this is a rather unlikely happening.

Where red scale is persistently present in large numbers on orange and mandarin trees in this district, the health of the trees needs attention and this should be the first step in the control of the pest. Artificial control may generally be accomplished by the use of straight oil, or if the Maori be prevalent late in the year oil-lime sulphur combinations may be used with good effect. White louse should be kept under control in this district, and the normal method of control for this pest should be regularly employed.

Blackall Range.

The Blackall Range district is somewhat akin to the Tamborine Mountain area, but a greater proportion of the orchards on the Range are protected from the strongest winds, and though winds are constant they are of less importance here than in the Tamborine area. For the most part well-tended orchards on the Range are not troubled to any extent by scale pests, and in general it will be found that if the resin-soda-fish oil spray be applied as recommended against the bronze orange bug nothing further need be done towards the control of the scales. As the spray forms no harmful combination with residue left after Bordeaux

spraying, the occurrence of black spot and melanose will not ordinarily have any bearing on the control of scale insects. Pulvinaria and mussel are the dominant scale species, and though the former is at times the more numerous the latter must be considered the more dangerous. In isolated parts pink wax sometimes occurs in pest proportions and thus may call for special attention. In such cases the recommendations made for the control of pink wax as an individual species hold.

Nambour to Gympie.

Generally speaking pink wax is the most important species of citrus scale insect in the smaller citrus-growing areas between Nambour and Gympie and in the Mary River Valley. Red scale, however, is rather abundant in parts, and if the trees be situated in humid parts mussel scale quickly takes advantage of lax cultural operations. For the most part the recommendations made for the Palmwoods-Woombye-Nambour area apply to this district, but in the latter fumigation is practicable in many places and should be employed when and where effective.

Burrum.

Pink wax is the outstanding scale pest of the Burrum district. Mussel scale is also very prevalent and commonly follows up the injury done by the wax species. When these two pests alone are to be considered, fumigation in the early summer followed by oil-soap-washing soda combination or the resin-soda-fish oil spray in the late summer or autumn months is the most useful treatment. If the mussel scale is not to be considered the spraying may be made with soap and washing soda straight, but if the mussel scale predominate it is better to use the resin-soda-fish oil. In this district the late summer spray application is very commonly done much too early, with consequent poor results. The presence of brown spot disease on the Emperor of Canton mandarins may complicate the position by rendering fumigation impossible. In this case the Burgundy-soap and washing soda, or soap and washing soda spray may be substituted for the fumigation and then the late season application should always be one of the resin-soda-fish oil mixture. Straight oil sprays are often used in this district, but these sprays have little value here, and growers who use them extensively would, for the most part, be well advised to discontinue the practice. White louse is prevalent in the Burrum district, and lime sulphur should be used annually at the time recommended for the control of that scale.

Rockhampton.

Fumigation should generally be employed in the Rockhampton district, particularly in those parts where red scale is the dominant scale pest. The occurrence of the larger horned citrus bug may necessitate the use of fumigation a good deal earlier than it is recommended for use against the red scale. The subsequent treatment for red scale and its common associate in these parts—circular black scale—will depend to a very large extent on the seasonal conditions. If the weather remain hot and dry it is probably that the red scale will breed so rapidly and successfully that further combative measures may be necessary. It is in such times as this that the bug is most in evidence and that a second treatment is called for against that pest. If this be so there will be no need for any further special treatment for the scale insects. If the weather change early in the year, ordinarily the

red scale and the bug will both be quite effectively controlled by the one fumigation, but in such times in this district mussel scale may quickly assert itself. If this happen use should be made of the resin-soda-fish oil spray as soon as conditions permit, or if the mussel scale infestation be lighter oil-soap-washing soda may be used. Because an early fumigation for the bug has apparently given fairly satisfactory results orchardists cannot assume that no further treatment is necessary, and it is still always advisable to examine the trees carefully during March and ascertain the exact position with respect to red scale. If this be not done and the red scale position taken for granted, it may mean that a control will be found necessary early in the following summer, and this is to be avoided for reasons given in earlier paragraphs in connection with the control of red scale as an individual species.

In cases when the March examination suggests that the early (January) fumigation has not reduced the infestations to a point which ensures low populations during the following spring and early summer, a further treatment should be given before the winter. Fumigation may be again employed. More commonly spraying will be preferred and in this event oil, oil-soap-washing soda, or resin-soda-fish oil may be used according to whether there is any complication. If red scale alone be of importance straight oil will be quite satisfactory.

On occasions the occurrence of a fungal disease, which requires the use of Bordeaux mixture for its control may prejudice the use of fumigation or oil spraying. It is important that before Bordeaux is used the trees should be as free of scale as possible. To ensure this it may be necessary to use fumigation in the winter prior to the first application of the fungicide. The trees from then on must be given as good treatment as possible, and in the late summer or autumn months the resin-soda-fish oil spray must be used for the control of the scales. It is important that the trees be kept well watered and not allowed to suffer any more than can be avoided from dry weather conditions. Owing to the probability of high temperatures prevailing even as late as the end of March, the use of the resin-soda-fish oil spray or perhaps oil sprays will possibly be rather later than would otherwise be the case and this point must be borne in mind.

White louse must be kept under control in this district, and even if fumigation be practised it is advisable to use lime sulphur in the late winter as recommended for the control of this pest. The occurence of scab may affect the situation a little, particularly in the case of lemons. Generally, if the infestation be light, lime sulphur is substituted for the first application of Bordeaux, but this almost certainly leads to a loss in fungicidal effect, and cannot be recommended against heavy scab infestation. If the amount of scab be large it is better to confine the lime sulphur application to the trunk and main limbs, and use the Bordeaux on the outside only for the first spraying. The second application of Bordeaux will not be influenced by the previous use of lime sulphur.

In isolated parts of the Rockhampton district pink wax and the long soft scale are common almost to the exclusion of red. In general these species may be combated in the manner recommended for the normal control of individual species. Mussel scale may be associated with these others, and this may necessitate the use of the resin-soda-fish oil spray if fumigation is not to be employed.

Yeppoon.

Pink wax and mussel scale form the most important pest combination in the Yeppoon district, and generally there is no other pest which will interfere with the adoption of the normal measures for combating those scales—i.e., the use of soap and washing soda at the time of appearance of the first brood of the pink wax followed by the use of oil-soap-washing soda or the resin-soda-fish oil spray in the late summer. The occurrence of the black passion bug, *Leptoglossus bidentatus* Montr., as an occasional migrant in large numbers to citrus may mean that it is much better to use the resin-soda-fish oil spray than the oil-soap-washing soda combination. Melanose is rather common in this district, and this may mean that the variation recommended for the Palmwoods-Woombye-Nambour district may be of value.

Byfield.

Pink wax is usually almost the sole scale insect of any moment in the Byfield area, and in normal years it reaches greater intensity in this part than in any other commercial citrus district in the State. Mussel scale may be associated with the pink wax, but the seedling trees, which are so commonly grown in the Byfield district, appear to harbour less mussel scale than might be anticipated. The normal method of control as recommended for the control of pink wax alone will usually be applicable in Byfield. The fly speck fungus, *Leptothyrium* sp., is at times prevalent in the district, and for this reason the use of resin-soda-fish oil spray may be more desirable than the soap and washing soda spray.

Gayndah.

The Gayndah district is very similar to the Rockhampton one, except that mussel scale is much more uncommon in the former. The climates are similar, and the pests, other than scales and diseases, are common to both. Reference should therefore be made to the recommendations for the Rockhampton district.

Lockyer.

On the whole pink wax is the most important scale insect of citrus in this district. Mussel scale and circular black are also very common in places, and in dry times red scale quickly becomes abundant. Fumigation is usually practicable in this district, and its use is to be recommended in general. Pink wax will usually be associated with mussel scale, so that if fumigation is not to be employed the recommendations for the control of this combination as made for the Palmwoods-Woombye-Nambour district should be adopted. Red scale and circular black may be attacked with oil sprays or, if Maori be prevalent, the combination of oil and lime sulphur may be employed if conditions permit.

Black spot and melanose are rather common in parts, and if this be the case reference should be made to the recommendations made for the Burrum district.

Esk.

In this district fumigation is to be recommended. The general position here is similar to the Lockyer area, though red scale is more common in the former district. In general pink wax will be found in

pure colonies, and the red and circular black mixed on other trees. In such cases the recommendations made for the control of individual species will apply. When complications occur reference should be made to what has been given for the Nambour-Palmwoods-Woombye district or the information given under Rockhampton may be of value.

Roma and Far Western Districts.

In inland districts, such as Roma, red scale is the outstanding scale pest in normal times, and as conditions permit of fumigation this should be practised. A special reference to the control of red scale in such districts is included in the discussion on the control of that species as an individual pest. The larger horned citrus bug may cause modification of the procedure in the same way as given in connection with the Rockhampton district. For general purposes reference should be made to what has been written on Rockhampton.

NOTES ON EXPERIMENTAL WORK.

What follows is a brief outline of the methods used in the course of the investigations in procuring and using data.

Life History Breeding Work.

The data concerning the life history of each species were obtained in the following manner, except where has been mentioned otherwise in the text:—Adult females about to reproduce young were kept in the laboratory. In the first place, as the young emerged these were removed each day until sufficient young emerged on one day to commence a large enough colony. When these large batches were present they were transferred to a leaf either by gentle shaking or with the aid of a single fine hair. In the cases of pink wax, hemispherical, mussel, cottony cushion and white louse, the young transferred were definitely not more than nineteen hours old—i.e., 5 p.m. to 9 a.m.—but in the case of white wax, red scale, and circular black scale, owing to the habit of the young of remaining beneath the female for some time after emergence and the great difficulty of obtaining them without injury before they crawl out of their own accord, the young were collected as they emerged naturally from under the mother scale. In these cases the times were taken from the emergence from beneath the mother to that time in the following generation. As soon as the young were placed on the leaf this was fixed on a small tree known to be free of scale. The leaf was so placed that the young had to crawl from it on to the tree, and thus the number of injured young in the colony was greatly reduced. After infestation in this manner the experimental tree was enclosed in a cage of finewire gauze, and thus shielded until such time as chance arrivals from outside sources could be recognised. After that time the gauze was removed and the tree left entirely unprotected, and thus under quite natural conditions. In each case the tree used was of a variety commonly found to harbour the species in the orchard. Thus pink wax was bred on Emperor of Canton, red scale on Late Valencia and lemon (fruit hung on tree), hemispherical scale on Beauty of Glen Retreat and Late Valencia, Pulvinaria on seedling orange, white wax on seedling orange and Scarlet mandarin, white louse on Glen Retreat and seedling orange, circular black on seedling orange and lemon, mussel scale on seedling

orange and Late Valencia, Cottony Cushion on Late Valencia and seedling orange, and soft brown on Scarlet mandarin and Joppa. The number of individuals in each colony was between 200 and 1,000. Observations were carried out with such frequency as was suggested as necessary by the development. Thus, as maturity approached, observations were made daily. In addition to inspection of the whole colony on the plant as muturity approached, a number of individuals were removed each day and examined in the laboratory. The number thus examined varied from five to ten daily up to the time that eggs or, in the case of viviporous species, young were becoming numerous. For this work, as far as possible, the most forward individuals were selected. The females were gently lifted slightly in the first place to ascertain whether or not reproduction was under way. If reproduction was found to be in progress the examined females were removed. The periods given as the developmental ones are the periods occupied by the greatest number of individuals and are not averages of the times taken by all the individuals. The second and subsequent generations were started as follows:—In each case a new tree was used. With pink wax, white wax, circular black, hemispherical, and Pulvinaria scales, old females beneath which were crawling young were placed on the new tree at the time of greatest reproductivity for the previous colony. These females were allowed to remain on the tree for twenty-four hours, and then were removed. In the cases of red, mussel, and white louse, the number of young produced by any one female in twenty-four hours was too small to permit of this method being used. With these species the procedure described for the establishment of the original colony was repeated at each generation, the females of the previous experimental lot being used to provide the young.

Whilst these experimental colonies were under observation specimens from each of the following districts were examined at short intervals:—Howard, Burrum, Montville, Mapleton, Palmwoods, Gatton, and Gayndah. These specimens were selected by various orchardists as being typical of the scales in their orchards at the time of forwarding. The interval at which these specimens were forwarded varied with the state of development of the scales from two months during the winter to one month in the summer and ten days at the time of reproduction. The data obtained from these specimens were tabulated against that from the experimental colonies at Nambour. Visits were made to each of the centres mentioned, and others at irregular intervals throughout the investigation, and in this way a check was kept on all specimens.

Tests of Scalicides.

In testing the scalicidal value of the various materials the following methods were employed:—In the cases of slow breeding species, such as Pulvinaria and white wax, direct counts were made, the only point being that the insects counted were confined to parts that would be readily reached by the spray. In the case of pink wax, migration is such an important factor that the procedure must be varied a little. In this case, from every tree twenty to thirty leaves were taken and the average number of living young per leaf computed. As soon as possible after this the application was made, and as soon as the living and dead

scales were easily differentiated a second count was made. The following figures from one experiment will show the results obtained in this way:—

First count .. .. 26th April, 1934
Sprayed .. .. 29th April, 1934
Second count .. .. 12th May, 1934

Young scale only counted. Practically 100 per cent. of old scales dead in all cases.

Sprayed trees—

Average living young at first count	10·5
Average living young at second count	·26

Unsprayed trees—

Average living young at first count	12·0
Average living young at second count	14·0

Percentage improvement due to spray, 97·99 per cent.

The percentage improvement is calculated in the following way:—The average number of young on the unsprayed trees had increased from 12·0 to 14·0; so that, assuming the same conditions on the sprayed trees, apart from the effects of the spray, the 10·5 average on these would have become 12·25. Thus the trees have improved from 12·25 to ·26, or 97·99 per cent.

With red, Circular black, and mussel scales counts were made, and the averages computed on all trees immediately before the application and six weeks later. The experiment quoted in the section "The Importance of Time of Application" gives the results of this method. In that experiment it will be seen that the scale on the unsprayed trees increased from 24·45 to 416·6, whilst on the sprayed trees the average decreased from 31·5 to 16·8. Assuming the same conditions for all trees except in so far as the application of the scalicide is concerned, it will be seen that in the interval the 31·5 scales of the sprayed trees, if unmolested, would have increased to 536·7, whereas actually the average was only 16·8, or but 3·1 per cent. of this total. Therefore it is assumed that the spray had had a lethal value of 96·9 per cent.

The six weeks' interval was chosen, as it was found that counting within a shorter interval than that did not always give quite reliable data, due, no doubt, to the comparatively small number of scales which can be handled in a reasonable length of time. By waiting for six weeks the position is much more clear, for in that interval many of the dead scales have fallen, and those which remain on the tree are quite easily distinguished from the living. This method is, of course, only possible for species with which migration is not a factor. The fact that reproduction is constant and rapid is an advantage, in that the increase tends to magnify the differences between sprayed and unsprayed trees without altering their absolute relations.

In laying out the experimental plots, trees of one variety in as compact a block as possible were used. Thorough examination of the trees was made in the first place to ensure that scale infestations and general conditions were comparable. In determining which trees should be used as checks and which given particular treatments, a method of randomisation involving the use of two series of numbered pellets was

used. In making all counts, only parts of the tree easily accessible were taken into consideration. These tests were, for the most part, concerned only in determining the lethal value of the materials.

In testing the value of actual treatments, it was assumed from the work in other countries that hydrocyanic acid gas would probably give satisfactory commercial control lasting not less than twelve months. The problem then became essentially one of discovering just when the fumigant should be applied. The experiments then were ones of trial and error, using the facts concerning the life history and habits as these became known. In this way each part of the investigation helped to elucidate data for the other. It has not been possible to test every brand of spray over a full twelve months, but it is reasonable to assume that if hydrocyanic acid gas gives a kill of 99 per cent. and a spray of 96 per cent. "kill," the controls will be, roughly, in the proportion of 99:96 provided both are applied at the same time.

SUMMARY OF INVESTIGATIONAL WORK.

1. Fourteen species of scale insects are recorded as attacking citrus in Queensland. Two of these species are recorded for the first time as pests of citrus in this State. *Pulvinaria cellulosa* Green appears to be a new record for the State, and *Paralecanium expansum* Green, though previously recorded from *Ficus macrophylla* Desf., has not previously been found on citrus. The evidence obtained throws doubt on the occurrence of *Lepidosaphes gloveri* as a pest of citrus in Queensland.

2. The economic status of the group and of each species and the factors tending to magnify or minimise the importance of each species are discussed.

3. The seasonal life history and habits of each of the important species have been studied and recorded.

4. Questions dealing with the natural enemies have been investigated, and notes are given on the more important species of these. With only one species—*Ceroplastes rubens*—it is considered that the introduction of further natural enemies is likely to be attended by worthwhile results.

5. The control of individual species has been the subject of experimental work, and the conclusions arrived at are given.

6. Special attention has been given to ways of combating the common complexities of pest and diseases which include scale insects.

7. The resin-soda-fish oil spray has been the subject of much work, and it is concluded that though the spray is somewhat cumbersome to prepare it is a most valuable scalicide, particularly in those cases where copper containing fungicides must be used. Apart from its use under these circumstances, the spray has proved itself very little inferior to hydrocyanic acid gas as a scalicide.

8. Special attention has been paid to oil sprays. It is concluded that with the introduction of the highly refined white oils much of the objection to the use of oil on citrus is overcome. The discontinuance of the general use of red oil is advocated. It was found that oil sprays are used very often quite wrongly, and growers are advised to use this class of spray only when they are certain that the desired result will be obtained.

9. Questions concerning the mixing of two sprays and following of one spray by a second have been investigated, and for the most part the results given were obtained in experiments on commercial orchards.

ACKNOWLEDGMENTS.

By forwarding regular supplies of specimens, and from time to time carrying out tests with sprays or fumigants, the following have rendered much assistance and thanks are tendered to them:—Messrs. J. W. Howie, Horticulturist, Queensland Agricultural High School and College, Gatton; J. L. Smith and S. Remmington, Palmwoods; W. Duggan, senr., Burrum; C. E. Farmer, Howard and R. A Ulcoq, Gayndah The writer is particularly grateful to Mr. F. C. Robinson, of Gayndah, who throughout the work placed almost his entire orchard at his disposal for experimental work and assisted in many other ways also.

Mr. R. L. Prest's co-operation in fumigation and spraying experiments was much appreciated. Thanks are also tendered to Mr. Helmsing for his illustration work, and to those members of the entomological staff who assisted on all possible occasions. The identification of all Chalcid wasps was made by Mr. A. A. Girault, and the pathological section supplied determinations of the entomogenous fungi.

To my Chief, Mr. Robert Veitch, I am also indebted for much valuable advice and criticism.

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For further information concerning those insects and diseases mentioned as having bearing on the control of scale insects, growers are referred to the following publications of the Department of Agriculture and Stock, Division of Entomology and Plant Pathology:—

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Bronze Orange Bug—Entomological Leaflet 18, by W. A. T. Summerville.

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SEAT FOR THE HARROW.

A harrow having no seat can be provided with one, as shown in the drawing. The seat support is made of 1-inch by 6-inch and 2-inch by 6-inch wood, securely nailed together as indicated in the lower right-hand detail. Two holes are drilled through the lower end of the 2-inch by 6-inch uprights to accommodate the axle of an old wheel, which can be taken from some discarded implement. Parts of an old cultivator, with collars and a brace added as shown, is used as an axle for the wheel.

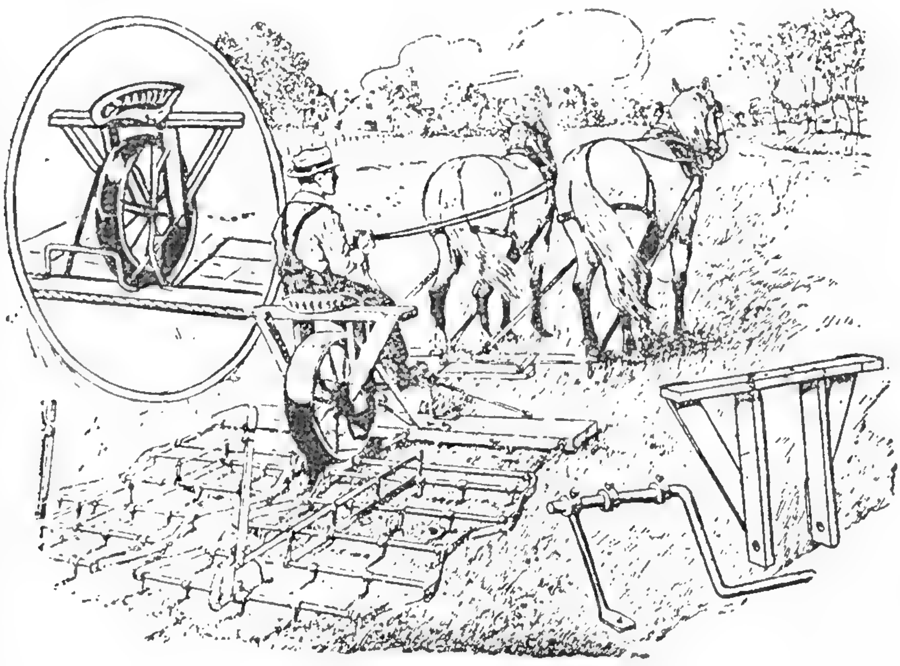

PLATE 74.

It is securely fastened to a 2-inch by 6-inch "draw plank," which is attached to the front of the cultivator. Additional flat-iron braces are provided to hold the seat support rigidly to the draw blank, and a foot-rest, made of ½-inch iron rod and bent to the shape indicated, is also attached to the draw plank. An iron seat from a discarded implement is fastened to the support in the most convenient position for the driver. In use, the wheel rests on the ground, and when the horses are walking, the draw plank is raised from 2 inches to 4 inches, while at the standstill it rests on the ground.

Parasites of the Pig.

By F. H. S. ROBERTS, M.Sc., Entomologist, Animal Health Station, Yeerongpilly.

EXTERNAL PARASITES.

THE principal external parasites of the pig include lice and mites, the latter being responsible for mange conditions.

Lice (*Hæmatopinus suis*).

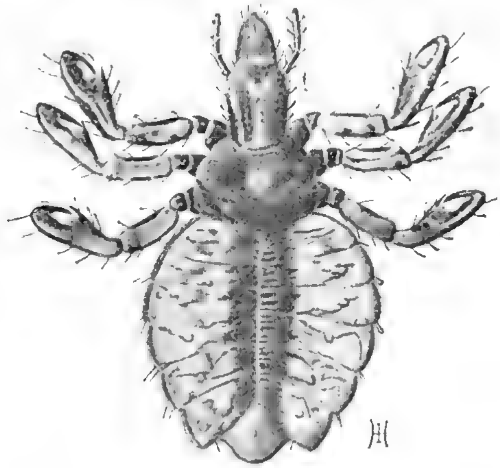

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PLATE 75.—PIG LOUSE (*Hæmatopinus suis*). Ten times natural size.

Pig lice, *Hæmatopinus suis*, are found everywhere in Queensland where pigs are reared. The species is one of the largest lice known and may measure up to one-quarter of an inch in length. The male is smaller than the female and may be readily distinguished by the presence of a black streak on the underside of the abdomen. The mouthparts consist of a proboscis or beak with which the louse is able to pierce the skin and suck up blood. This continual puncturing of the skin causes considerable irritation, which may in time so lower the vitality of the animal as to produce an unthrifty condition and render it more susceptible to attack by other parasites and diseases.

Life History.

Eggs deposited by the females are glued to the bristles of the pig and hatch in from 12 to 20 days, usually in about 14 days. The young louse is very similar in appearance to the adult, differing mainly in size. After hatching, the young lice immediately commence feeding, and after 10 to 12 days become mature. Lice may live as long as 35 days and during her lifetime the female lays about 90 eggs.

Mites.

Two species of mites infest the pig, each of which is responsible for a condition of mange. One species causes Sarcoptic mange, the other, Demodectic mange.

Sarcoptic Mange (*Sarcoptes scabiei suis*).

Sarcoptic mange or common mange is caused by the mite *Sarcoptes scabiei suis*. This mite is very small, at most only one-fiftieth of an inch long, and whitish in colour. The body is rounded with four pairs

of short thick legs, and provided with a number of short backwardly projecting spines on its upper surface. The parasites live in galleries under the skin in which the female lays her eggs. These eggs hatch in 3 to 10 days and after another 10 or 12 days, the young mite becomes sexually mature. There is thus a new generation produced at least every 13 days.

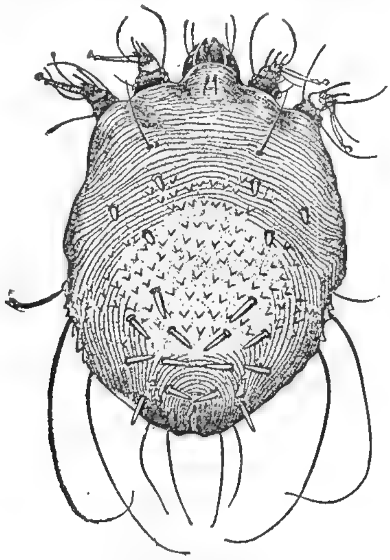

Plate 76.—Sarcoptic Mange Mite.
Female. Magnified 100 times.
[*From Farmers' Bulletin* 1085, *United States Department Agriculture.*

Symptoms of Sarcoptic Mange.

The burrowing of the mites through the skin causes the skin to become inflamed and swollen. At first, these inflamed areas are very minute, but in time become very conspicuous and as the mites increase the lesions gradually coalesce. The irritation causes the animal to rub itself against any convenient object, the areas become raw and bleeding and large scabs are formed. The movements of the pig causes a continual breaking of the scabs and blood and serum ooze out from the cracks. The bristles on the affected area fall out and eventually only a few or none remain. Later the skin becomes hard, thickened, and thrown into folds. In severe cases the animals affected become weak and emaciated and unless treated may die.

In the early stages of the disease the lesions usually occur on the head, around the eyes, ears, and nose, and from here the disease spreads along the neck and shoulders until the entire body may be affected.

Demodectic Mange (*Demodex phylloides*).

This type of mange is caused by a very minute worm-like mite, *Demodex phylloides*, and is much less common than Sarcoptic mange. The mites of Demodectic mange are microscopic in size, measuring up to one one-hundredth of an inch. They spend their entire life in the hair follicle or sweat glands, and when in numbers cause well-marked lesions. These lesions usually appear first on the snout or around the eyelids and from there spread slowly over the throat, breast, abdomen, and other parts of the body where the skin is soft and thin. The effected skin becomes reddish and scurfy with numerous small hard nodules. These nodules eventually break and discharge a creamy pus, and many of them may run together to form suppurating cavities.

Diagnosis of Parasitic Mange.

The pig at times may be subject to many various skin diseases, and for an accurate diagnosis of Sarcoptic or Demodectic mange it is best to submit samples of scrapings from the affected skin for examination. The scrapings, to include the mites, should be taken from the more recent lesions, and should be made deep enough to cause the appearance of blood. The scrapings should then be placed in a tightly-corked tube or bottle and forwarded for examination.

Control of Lice and Mange.

For the control of lice and mange, crude oil or fuel oil will be found satisfactory. The oil may be easily applied by hand, and owing to its adhesive and spreading qualities only comparatively small quantities are required. In the case of lice, a second application is desirable after fourteen days. For severe cases of Sarcoptic mange frequent dressings are necessary; but tests have shown that a complete cure may be expected provided careful and persistent treatment is given. Before being treated with the oil, the affected animal should be thoroughly scrubbed with warm soapy water.

No specific cure is known for Demodectic mange, but frequent applications of crude petroleum check the disease. Animals not responding to treatment should be killed. Animals oiled with crude oil should be kept in the shade as much as possible until the oil has dried, as contact with the sun is likely to cause blistering.

Hog oilers and medicated wallows and dips are frequently recommended as methods of controlling lice and mange. Hog oilers consist of posts wrapped round with oiled ropes or sacking and placed at some convenient spot, the idea being that the pigs will rub themselves against the post so that a small quantity of oil is deposited on or near the area of skin being rubbed. These devices tend to lessen the spread of lice and mange, but, as the pig will rub against any convenient object, are not to be depended upon to effect eradication or prevent the losses caused by heavy infestations.

By taking advantage of the pig's natural tendency to wallow in water, especially during warm weather, the use of crude oil on the surface of the water will be found satisfactory for the control of external parasites. The wallows should be constructed of concrete, and the water, with its film of oil, should be of just sufficient depth so that the nostrils can be easily kept above the surface of the liquid. For pigs of 40 to 80 lb. weight the depth should not exceed 3 inches, 6 inches being the maximum for the largest pigs. If the depth is too great the animal is afraid to lie down. The wallow should be roofed over to prevent the water becoming too hot. The wallow, moreover, should not be kept oiled continuously, but for short periods every ten days, until the desired results are obtained.

Dipping is one of the most effective treatments for lice and mange. The dip consists of a concrete bath 40 to 48 inches deep, with a total length of at least 7 yards, constructed on the same general principles as a cattle dip. The oil dips are usually considered the most economical and most dependable dips, and of the oils available, crude petroleum is recommended. The dip is filled with water, on which the oil is poured to a depth of 4 or 5 inches.

Attention should also be paid to sanitation. As lice will not live for more than three days off the pig, it is not considered that sties which have housed infested pigs would be a source of danger under sanitary

conditions. It is always better, however, that such sties should be given a thorough disinfection and cleaning before clean pigs are placed in them.

Mange is highly contagious, and pigs showing symptoms of mange should be immediately isolated. Visible lesions of Sarcoptic mange may develop in fourteen to fifteen days; so animals in contact with affected pigs should be isolated for this period. All litter and manure should be cleaned up and burnt and the sties given a thorough disinfection. It should be remembered that Sarcoptic mange is transferable to man; so it is advisable, after handling affected pigs, to bathe and have a complete change of clothing.

INTERNAL PARASITES.

No less than seventeen internal parasites or worms have been recorded from the pig in Queensland, but fortunately many occur only in small numbers and are not of any economic importance.

Flukes and Tapeworms.

In Queensland, flukes are unknown in the pig, except for rare instances when the liver fluke of sheep, *Fasciola hepatica*, has been observed in the liver.

The pig does not harbour any species of adult tapeworm but may act as a host for two larval tapeworms which reach maturity in the dog. These larval forms are known as *Cysticercus tenuicollis* and *Echinococcus granulosus*. Only the latter is of importance, as it is the cause of hydatids, which is a serious disease in man.

In the pig, the larval hydatid usually occurs in the liver and lungs, and consists of a bladder of fluid containing numerous minute white specks. Infestation may be prevented by seeing that the pigs are not given access to the fæces of dogs, by thoroughly boiling all offal before feeding it to dogs, and also by regular treatment of all dogs with an efficient vermifuge to remove the adult worm.

Roundworms (*Stomach Worms*).

Description and Life History.

Four species of stomach worms are known, of which two species, *Arduenna strongylina* and *Physocephalus sexalatus*, may be of some importance. Both these worms are whitish in colour, up to seven-eighths of an inch in length, and are found usually at the exit end of the stomach. Their life histories are similar and very interesting, in that the eggs, when passed out in the dung, are eaten by various dung-frequenting beetles. In these intermediate hosts the eggs hatch and the larvæ undergo certain development. The pig can only become infested when it eats the beetle containing the larvæ.

Control.

Control consists in the daily removal of all dung and the clearing up of all litter, &c., which might afford shelter to the beetles. No efficient drug is known which will remove the parasites, but oil of chenopodium, as recommended for *Ascaris lumbricoides*, might be tried.

The Large Round Worm (*Ascaris lumbricoides*).

This species is one of the largest roundworms known and may grow up to 15 inches in length. The parasite occurs in the small intestine and frequently in very large numbers.

Life History.

The eggs laid by the female worms pass out in the dung, and under suitable conditions of temperature and moisture become infective in about eighteen days. These infective embryos when swallowed by the pig hatch and the young larvæ immediately bore into the intestinal wall. From there they are carried in the blood stream to the liver, and still continuing their migration reach the blood capillaries, and are moved on to the heart, and from there to the lungs. About ten days after hatching the larvæ leave the lungs, move up the windpipe into the mouth, are swallowed, and reach the small intestine again, in which they settle down and grow to maturity.

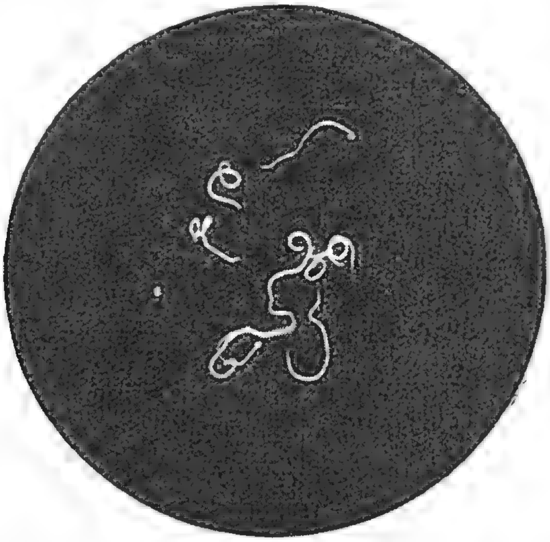

PLATE 77.—STOMACH WORMS (*Arduenna strongylina*). Natural size.

Effect on the Pig.

Only young animals up to four and five months of age are affected by Ascaris infestation. The larvæ burrowing through the liver and lungs cause serious disorders. Lung destruction may result in a condition of pneumonia, which may sometimes be fatal. A heavy infestation means a stunted and sickly animal, which becomes unprofitable. The invasion of the lungs by the migrating larvæ occasionally produces a condition known as "thumps," in which the breathing is laboured and bellows-like. More often, however, destruction of the lung tissue is shown by a short, hard, cough, which is especially prominent after exertion.

Control.

Treatment of infested animals with oil of chenopodium at the rate of 1 cubic centimetre for every 25 lb. weight to a maximum dose of 4 cubic centimetres will remove the majority, if not all, the worms from the small intestine. This drug is given with or immediately followed by castor oil, 1 to 2 oz. being used, depending upon the dose of chenopodium administered. The animal to be treated should be starved for twenty-four hours before and for four hours after the drug is administered. It is not advisable to treat animals under six weeks old. As one dose of chenopodium cannot be depended upon to remove all the worms from every pig, the dose should be repeated after an interval of ten to fourteen days.

Although oil of chenopodium is highly efficient in removing the worms from the small intestine, it is entirely without effect on the larvæ

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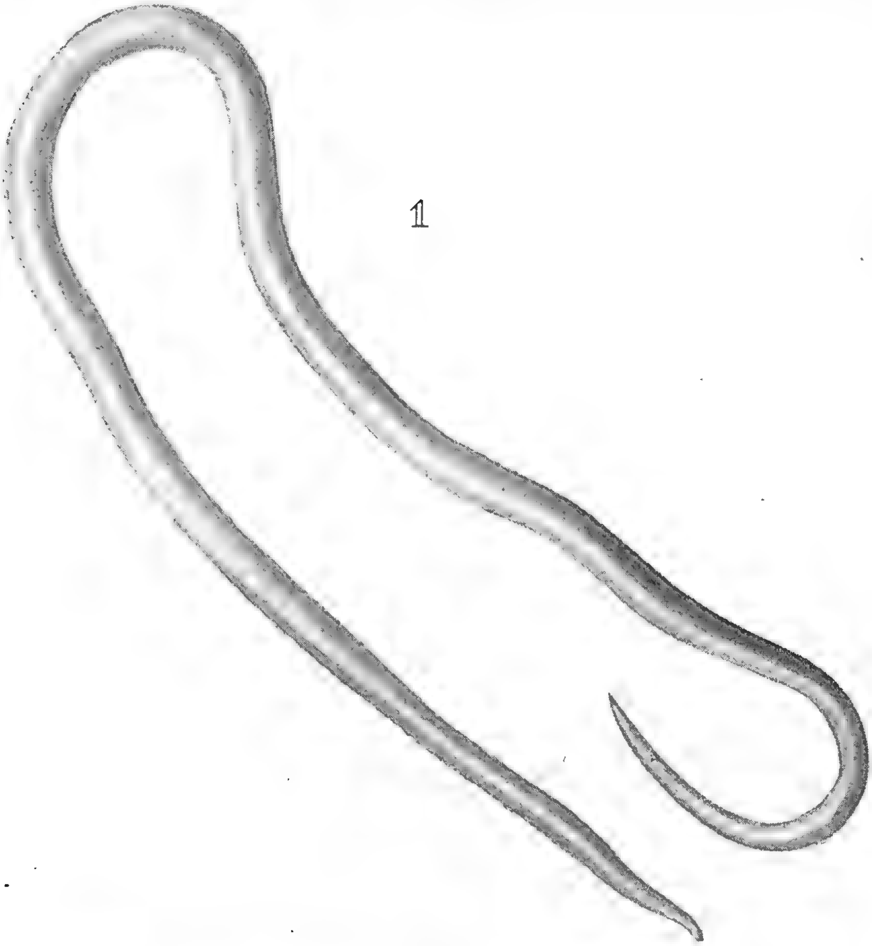

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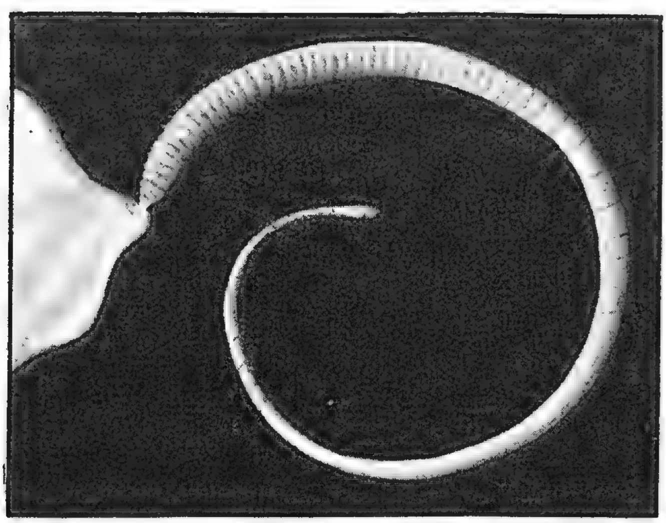


I. W. Helmsing. 1929.

PLATE 78.

Fig. 1.—Large Round Worm (*Ascaris lumbricoides*).

Fig. 2.—Thorn-headed Worm (*Macracanthorhynchus hirudinaceus*).

Natural size.

in the liver and lungs, and in order to minimise losses through the presence of this stage in the life cycle, preventive measures must be adopted.

During its lifetime the female worm is said to lay as many as 27,000,000 eggs; and as these are very resistant to adverse conditions,

PLATE 79.

All these four pigs are from the same litter. The two smaller animals are infested with worms. The two larger animals are worm free. Note the differenc in growth.

the sties and yards become so heavily contaminated with eggs that the animals swallow large numbers of infectious eggs every day. Sanitation is therefore the keynote of prevention. Daily removal of all dung, a good drainage system that keeps the yards and sties as dry as possible, the use of pens with concrete floors, and keeping the animals' food off the ground are all necessary for Ascaris control.

A system of pig-rearing in use in the United States has been highly successful in controlling, not only Ascaris infestation, but also infestations with other worm parasites. As Ascaris is harmful only to pigs up to four or five months of age, this method aims at keeping the young pigs away from the old contaminated yards till they reach this age. Certain modifications have been made which it is considered will make this system more practicable and more efficient under Queensland conditions.

Certain of the sties are set aside for farrowing purposes only, and it is essential that these have concrete floors. A few days before the sow is due to farrow the sty is given a thorough and careful cleansing and finally washed down with liberal applications of a boiling five cent. disinfectant solution. Kerol is recommended for this purpose, but in its absence any disinfectant with a high tar acid content, 25 per cent. and over, may be used. Make up the solution, boil, and without any delay apply it to the floor and walls of the pen.

Next, wash the sow with a warm soapy solution, remove all dirt and mud crusts, paying particular attention to the feet and udders. She should then be oiled to keep lice worry at a minimum, a second treatment being given after an interval of about fifteen days. In getting her into the prepared pen, she should be hauled and not driven.

After farrowing the sow and litter are placed either on fresh ground or ground on which pigs have not been running for a number of years. For this purpose three separate pastures are advised, each of which is subdivided. The one to be used by the young pigs should be previously prepared by sowing with a suitable forage crop, and in order to avoid any wastage of land the other two pastures could be given over to some profitable farm crop.

The period spent in the pen after farrowing depends on the number of sows farrowing. If only one or two sows are concerned, they and their litters may be placed in the pasture a few days after birth; but a three weeks' period is advised, for by this time the young pigs will be strong enough not to suffer through any possible robbing by their older and stronger fellows running in the same pasture. During these three weeks spent with the mother in the pen strict sanitation is necessary.

Only one division of the specially prepared pasture should be used, and when weaned the animals could then be placed in the second division, where they are kept till at least four months old. Next year, one of the two other pastures is used for the pigs, thus ensuring that each pasture does not run pigs for a period of two years, during which time it is considered that if proper cultivation practices are adopted very little infection, if any, would be surviving.

In cases where no such pasture land is available, the farmer is advised to remove the top 9 inches to 12 inches of the old contaminated soil from the yard attached to the farrowing pen and replace it with new, clean soil, preferably sand. Only the young pigs should be allowed to use this yard, the exits from the pen being made too small for the sow to pass through. Strict supervision should be given the cleanliness of the pen, which every two weeks should be given a disinfection with a boiling 5 per cent. solution of Kerol.

The Thorn-headed Worm (*Macracanthorhynchus hirundinaceus*).

Description and Life History.

This is also a large species occurring in the small intestine, the female worms attaining a length of 7 to 16 inches. The parasite is whitish in colour, and its head is provided with an armed proboscis with which the worm attaches itself to the intestinal wall.

The eggs are passed out in the dung, and for the life cycle to be completed must be consumed by certain beetle grubs. The eggs hatch in the intestine of the grub, and the young larvæ forcing their way through the intestinal wall reach the body cavity, where they encyst. The pig, in rooting about, finds the grubs and eats them. The encysted worms are released and attach themselves to the wall of the small intestine by means of their proboscis, and eventually reach maturity.

Effect on the Pig.

The thorn-headed worm is fortunately not very common, but moderate to heavy infestations are sometimes seen. The worms are

continually moving about in the small intestine and reattaching themselves, and consequently severe damage to the intestinal wall is occasioned. The infested animal shows evidence of great pain, may be subject to nervous disorders, and rapidly loses condition.

Control.

There is no drug known that can be depended upon to remove these worms, but the treatment as recommended for Ascaris may lessen the infestation. Strict sanitation must be maintained, and anything that will prevent the pig rooting around and eating the beetle grubs should be considered.

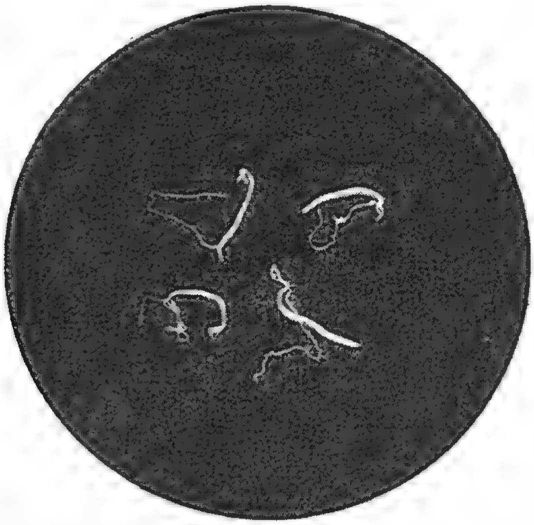


PLATE 80.—WHIP WORM (*Trichuris trichiura*). Natural size.

Whip Worm (*Trichuris trichiura*).

This parasite gets its common name from its resemblance to a whip, the anterior portion being thin and thread-like, and the posterior portion comparatively stout. It is found in the caecum and adjoining portion of the large intestine, and may measure from 1½ to 2 inches in length.

The eggs laid by the females pass out in the dung, and under suitable conditions of temperature and moisture develop into infective embryos. On being swallowed by the pig these infectious eggs hatch, and the young larvæ, making their way to the caecum and large intestine, reach maturity in sixteen to twenty days.

Control.

The whipworm is an exceedingly common species, and it is considered that a heavy infestation may be distinctly harmful. Repeated treatments with oil of chenopodium may give results, but owing to its location so far back in the alimentary tract the worm is difficult to reach with vermifuges. The sanitary measures as recommended for Ascaris should be applied for whipworm control.

Nodule Worms (*Œsophagostomum* spp.).

Description and Life History.

Two species of nodule worms are known, *Œsophagostomum dentatum* and *O. longicaudum*, the latter being comparatively rare. Both

occur in the large intestine, are whitish or greyish in colour, and may measure up to three-quarters of an inch in length.

The eggs, in this case, after passing out in the dung, hatch, and the young larvæ feed in the dung for several days before reaching the infective stage. The larva is now enclosed in a sheath which helps to protect it from adverse conditions. When swallowed by the pig the larva loses its sheath and burrows into the wall of the large intestine, causing the formation of a small nodule. After a period of development in the nodule, the larva eventually breaks out and settles down in the intestine and grows to maturity.

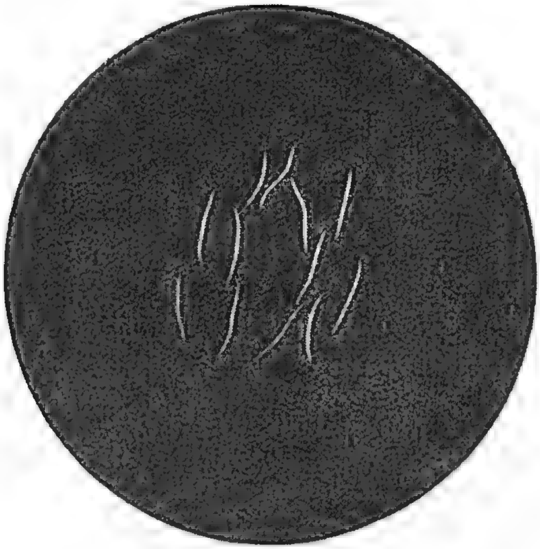


Plate 81.—Nodule Worm (*Œsophagostomum dentatum*). Natural size.

Control.

Nodule worms are most harmful to young stock, and a heavy infestation may result in general unthriftiness. No treatment with drugs is known to be effective for nodule worm, and the only control measures are concerned with sanitation.

Lung Worms (*Metastrongylus* spp.).

Description and Life History.

Two species of lung worms are known, *Metastrongylus apri.* and *M. pudendotectus.* Both are long, thread-like worms from 1½ inch to 3 inches long, occurring in the air tubes of the lungs.

The eggs which are laid by the females contain active embryos which hatch in the lungs. The larvæ may be swallowed and passed out with the dung, or else may reach the exterior in the nasal and bronchial discharges. Before its development can be completed the larva must now be swallowed by an earth worm, the pig becoming infected when it in turn eats the earth worm.

Effect on the Pig.

A light infestation causes no appreciable harm, but when in numbers, and especially in young pigs, the worms may cause a bronchitis char-

acterised by a short, husky cough, and sometimes followed by pneumonia. The infested animals rapidly lose condition and, if bacterial complications arise, may die.

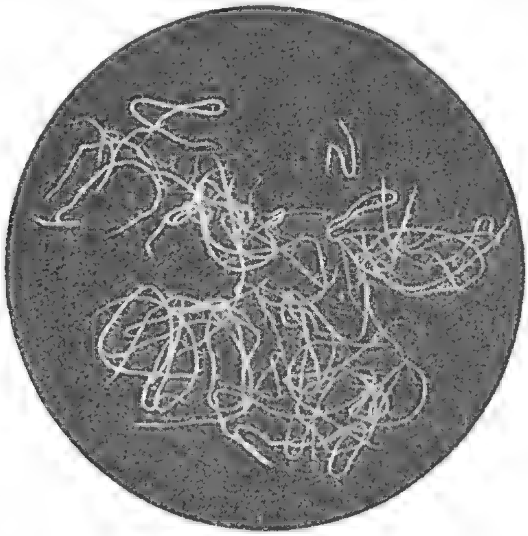


PLATE 82.—LUNG WORM (*Metastrongylus apri*). Natural size.

Control.

Should an outbreak occur, the unaffected pigs should be immediately removed and the infested animals given good, clean water, nourishing food, and warm quarters. Good nursing is the best treatment for lungworm infestation. All conditions permitting the presence of earth worms must be attended to, and sanitation again is necessary for an efficient control of these parasites.

Kidney Worm (*Stephanurus dentatus*).

Description.

This parasite is given the popular name of kidney worm because it is found in the vicinity of the kidneys. Mature worms are seen in the flare fat and occasionally in the kidneys themselves, while young stages

PLATE 83.—KIDNEY WORM (*Stephanurus dentatus*).
(*a*) Three times natural size. (*b*) Natural size.

of the parasite, whilst most prominent in the liver, may occur in the lungs and various other parts of the body. The kidney worm has a very distinctive mottled appearance, is relatively stout, and may grow up to 2 inches in length.

Life History.

Only those females inhabiting the kidneys or kidney fat are sexually mature, and these lay eggs which eventually reach the exterior in the urine. The eggs hatch in one to two days, and five to eight days after hatching the young larvæ are ready to infest the pig. As in the case of the nodule worm, the infective larva is enclosed in a sheath. The pig becomes infected by swallowing these infective larvæ, or infection may occur through the larvæ burrowing through the skin. In any case, the young worm eventually reaches the liver, where it remains for some months. After a period of five to six months the worms are mature, and leaving the liver migrate to the kidney fat, where, if females, they commence to lay eggs.

Effect on the Pig.

Heavy infestations result in an unthrifty animal, owing mainly to the extensive damage to the liver caused by the young worms. It is one of the most widespread parasites of the pig in Queensland, and is certainly a cause of serious wastage. The condemnations of pigs' livers and infested carcasses for export purposes and the unthriftiness of infested pigs is regarded as one of the most serious economic losses the pig industry in Queensland has to contend with.

Control.

Owing to their location in the vicinity of the kidneys, these parasites cannot be removed by drugs given via the mouth, and only preventive measures will bring about a satisfactory control.

As the eggs and larvæ are rapidly killed by sunlight and dryness, yards and sties should be efficiently drained and kept as dry as possible. All depressions and mud holes, especially those in the shade, should receive attention, and if these cannot be kept dry they should be sprayed weekly with a 5 per cent. Kerol solution at the rate of 10 gallons of Kerol per 100 square yards. Sties should be built of concrete, or else have slatted floors, which allow the urine to drain through to the ground beneath. All litter should be constantly cleaned up, as the soil so protected forms one of the most favoured sites of the infective larvæ. Yards and sties spelled for six months may be used with safety, as larvæ cannot survive for this period, even under optimum conditions.

The system used for Ascaris control may be applied here with certain modifications. The pastures are prepared as already stated, ploughing and cultivation being very efficient in cleaning the land of infection. The food and water troughs in this case, however, are placed on bare, well-drained areas. The food troughs may be shaded, but the surrounding bare areas must be well exposed to sunlight. After feeding or drinking, the majority of the urine is then passed on this bare exposed land, and the eggs and larvæ are rapidly killed by the sunlight and dryness. Paths used by the pigs throughout the pasture should also be kept bare and well exposed.

SANITATION.

It has been aptly remarked that the harm resulting from worm infestation in pigs would be considerably reduced "if pigs were kept in a less swine-like manner." Without sanitation little can be accomplished in the control of any parasite. Even though treatment with a drug may be depended upon to remove all worms, there is little advantage in its use if the animals are able to become reinfested immediately after-

wards. So far as the pig is concerned, prevention assumes an especially prominent place in worm parasite control, for there is only one species for which an efficient vermifuge is known. This species is *Ascaris lumbricoides,* and even here treatment is of no effect against the more harmful phase in the life cycle—namely, the migrating larva. This point emphasises the need of good sanitation, which, by the elimination of conditions favouring the development of the life cycle stages spent outside the pig, considerably reduces the chance of infestation. The principals of good sanitation are outlined herewith:—

1. *Sties.*—In the construction of a sty the farmer should aim at concrete floors. The initial expenditure may be high, but the result is shown in the ease with which such sties may be kept clean and the subsequent good health of the pigs. Earthern floors in sties should be entirely abolished, as it is impossible to keep them clean and dry.

2. *Dung.*—All dung should be removed daily. The dung carries the eggs of those parasites inhabiting the alimentary canal, and its regular removal and disposal is important. If desired for fertilizing purposes, it should be spread out immediately in the pastures. It must be understood that pastures so treated should not be accessible to the pigs; otherwise the dung should be buried under 1 foot of soil. Pig dung is a favoured breeding medium of the house fly, which, when in numbers, not only becomes an annoyance to the animals, but also plays a very prominent part in the spread of disease. The proper disposal of the dung is important from this aspect also.

3. *Drainage.*—Moisture is a necessary factor for the development of the free living stages of all worm parasites, and in its absence very few of these can survive for any length of time. A good drainage system is therefore an essential for good sanitation, and the progressive pig raiser will see that all depressions are filled in and that mud holes are not permitted. If wallows are considered necessary, they should be built of concrete and frequently cleaned out and disinfected.

4. *Feeding.*—No food should be thrown on the ground, but supplied in sanitary food troughs. These are best built of concrete, evenly divided by round iron cross pieces, to prevent the animals lying in them. In yards, such food troughs should be surrounded by a concrete floor raised above the level of the ground and sloping away from the trough. Hoppers are advised for dry rations.

5. Keep the runways and yards as free of litter as possible. Accumulations of corn cobs, &c., protect any infection in the soil beneath from such adverse conditions as sunlight and dryness.

THE ADMINISTRATION OF VERMIFUGES TO PIGS.

It must be remembered that the pig has a peculiar narrow throat, and great care must be taken when administering drugs. With liquids the danger is somewhat increased, as they are apt to enter the lungs and suffocate the patient. Oil of chenopodium and castor oil may, however, be administered quite safely if the directions given below are carefully followed. The required amounts of the drug and castor oil are measured out and thoroughly mixed. Young animals are set up on their tail and

between an assistant's legs, the mouth opened by a spreader or gag. and the vermifuge administered very slowly over the back of the tongue by means of a syringe with a long curved nozzle (Plate 84, fig. 1). *The liquid should be given slowly and ample time given the animal to swallow.* Care should be taken not to force the head up too far.

Animals too big to be handled in this way are best placed in a crate or crush. A leather strap is used to elevate the upper jaw and bring the mouth level with the shoulder tops, the drug being then administered with the syringe in the manner described above. Failing a syringe, an old boot from which the toe has been removed is occasionally used for

PLATE 84.—DRENCHING A PIG FOR WORMS.

administering liquids; but with the syringe the work is quicker and each animal is given a full dose.

Oil of chenopodium may also be obtained in capsules. It is not always an easy matter, however, to dose pigs with capsules, and as, in any case, the capsules would have to be followed by castor oil, it is considered that the simultaneous administration of the drug and castor oil is much easier for the operator.

The administration of chenopodium in food is sometimes recommended, but cannot be considered as nearly as efficient as individual treatment with the syringe.

The Control of Insect Pests of Sugar Cane.

By R. W. MUNGOMERY.

IN common with almost all other plants, sugar-cane is attacked by a number of insects, the combined effect of which tends to weaken the plant and prevent to a greater or less degree the full functioning of its roots, stalks, and leaves. Thus, to cite a few examples:—"White grubs" attack the roots and underground portions of the stalk, and deprive the cane stool of its means of maintaining its normal supply of plant foods and water. Borers feed on the more succulent internal fibres of the stalk and interfere with the ready circulation of sap between roots and leaves. At the same time the tunnels of these borers, having access to the outside air, provide an easy entrance for certain fungi which cause serious internal rots. Caterpillars and grasshoppers at times consume almost the entire leafblades which are the "factories" wherein the cane sugar is manufactured. Evidently, therefore, any serious attack by an insect results in a curtailment of the plant's activities, and this is automatically reflected in reduced crop yields. It is true that the effect of some insects found attacking cane is almost negligible, whilst others, although potentially dangerous, are never present in sufficiently large numbers to cause noticeable damage. However, when insects become so abundant as to compete seriously with man in his efforts to raise crops, they then become pests, and some form of control must be instituted against them to prevent or restrict their damage.

The fundamental principles of insect control can be considered from four main standpoints, and these will be reviewed in their possible application to the control of sugar-cane insect pests. Such control measures may be divided into what may broadly be termed (1) cultural, (2) chemical, (3) biological, and (4) legislative methods.

CULTURAL CONTROL.

Cultural methods of control are such that, by some variation of, or concentration on a particular farm practice, the agriculturist aims at constantly placing the insect pest at a disadvantage, and either minimises or completely counteracts its otherwise harmful effects. Cultural methods of control are those which have been gained from the common experience of man in his fight against the many insect pests found damaging his crops. They may be classed as methods which usually readily suggest themselves and are more or less common knowledge, and for that reason they are most frequently put into operation to combat pests. Some of these farm practices may be summarised as follows:—

Summer Ploughing: It is well known that many soil frequenting insects are located in the upper soil levels during the warmer months of the year, whilst during the cold winter period they are found in a more or less inactive condition usually below plough level. Therefore, if ploughing be carried out during the summer, a much greater check is imposed on these insects than if the same operation were carried out during the winter.

Collecting and Hand-picking: The systematic collection of beetles from feeding trees in compact areas has generally been acknowledged to bring about a satisfactory reduction in the incidence of grubs during the following season; but in broken country, where collecting must of necessity be extensive and, at best, incomplete, the benefits to be derived from this practice are

doubtful. In some of the Southern areas boys are employed to follow behind single-furrow ploughs and to collect any grubs that may be exposed in the furrows. Provided this work is carried out thoroughly, it is possible so to clean the land that two or three crops may be grown subsequently without any serious grub damage. These remarks apply of course to the grubs with the two year life cycle which is characteristic of the Childers cane grub.

Excision: This form of control is sometimes employed against moth borers in parts of the West Indies and Java where labour is cheap, but this rather tedious practice finds little favour in Queensland.

Field Sanitation: The elimination of weeds and grasses is a common agricultural practice which tends to reduce insect infestation, some pests being originally attracted by untidy overgrown fields. Such a measure directly reduces the breeding grounds of moth borers and many sap-sucking insects, such as aphids and leafhoppers, which are the natural transmitting agents of many virus diseases, and it indirectly prevents the rapid spread of these diseases. Mosaic disease of sugar-cane is a notable example of a disease whose spread is influenced in this way by the presence of grasses.

Variation of Planting Date: Early or late planting to avoid pest damage is a point frequently stressed. In the former case, the crop is past the susceptible stage, or matured, before the pest is capable of doing any appreciable harm; in the latter case, the pest is usually full grown and about to enter a quiescent stage of its cycle when the crop is planted, and similarly, serious damage is obviated. In North Queensland it is generally agreed that late-planted crops are less subject to bad grub attack than the taller early-planted crops. Around the Mackay district, wireworm damage is, to a point, less severe in late planted blocks than in those planted early. In South Queensland, autumn planting usually ensures a good strike and freedom from a number of pests, whilst spring planted cane frequently suffers damage.

Resistant Varieties: Deep rooting varieties of sugar-cane such as some of the P.O.J. canes and D. 1135 are much more resistant to grub attack than are shallow rooting varieties such as Q. 813. Again, canes with a hard rind are less subject to rat and borer damage as compared with canes of the softer and more succulent types.

Burning of Cane Trash: This system is largely practised throughout Queensland, where it aids considerably in reducing the numbers of beetle borer, which would otherwise migrate to surrounding fields and commence new centres of infestation. It should always be borne in mind, however, that such practices simultaneously destroy the Tachinid parasite, and where this fly is established burning of trash is not to be recommended as a form of borer control. The disposal of trash in this manner also tends to reduce the incidence of army worms, but again these may be successfully and economically controlled by the use of poison baits.

The Rotation of Crops: Crop rotation is a desirable form of control when dealing with insects which attack only one of the crops under rotation, but in Queensland, with the possible exception of a few of our minor cane pests, it is doubtful whether this measure would afford any relief from our more serious cane pests.

Mechanical Methods: The use of implements in the field has been developed to a greater extent in Queensland than in any other sugar-producing country, and it is not surprising that the idea of obtaining a high degree of insect control has been incorporated in the building of some of the machines which are used in the ordinary course of cultivation work. In this connection we refer to an improved rotary hoe with the rotor revolving at a high speed, pulverising the soil to a depth of 7-8 inches, and

chopping the ground every 2 inches as the machine moves forward. With this implement a kill of 92 per cent. of the grubs present in the top 8-inch soil level has been obtained, and it is thought that with a few minor alterations, such as increasing the number of blades and thereby securing a finer cut, its efficiency might be even further increased. It is capable of treating 3 acres per 8 hours at a cost of approximately £1 per acre, and it has already resulted in a considerable saving in cleaning up grub-infested areas.

CHEMICAL CONTROL.

Chemical control consists essentially of the direct application of chemicals to kill insects, and naturally their use is governed largely by the relation between the cost of the chemical and its application, and the amount of profit that can be expected from the crop in question. Chemicals may be used as insecticides in the form of stomach poisons, contact poisons, or fumigants. In the case of poisons, the type of insecticide to be used depends chiefly on the mouthparts of the insect to be controlled; i.e., whether they are of the biting and chewing type such as those of grasshoppers and caterpillars, or whether they are of the suctorial type such as those of leafhoppers and aphids. Pests having chewing mouthparts are controlled by spraying or otherwise finely coating their food plant with some poisonous compound such as Arsenate of Lead or Paris Green, so that when feeding on these plants they consume a quantity of the toxic compound which ultimately result in their death. In America, when grub-proofing lawns and golf greens, it is customary to mix quantities of lead arsenate with the soil when the greens are being made, or subsequently as top dressings, and any soil insects which happen to ingest this soil are soon killed by this poison, which remains effective for many years. Insecticides are sometimes mixed with a carrier such as bran or sawdust to which attractive substances such as molasses and lemon juice are added, and the whole mixture broadcasted in areas where the pest has assumed importance. The well known bran poison bait is an example of a successful bait used to overcome army worm infestation.

Such methods are of no use in the case of insects with suctorial mouthparts, since they ingest juices from within the plant. They are usually controlled by means of a contact spray such as nicotine sulphate or various emulsified oils, all of which adversely affect their breathing organs and soon bring about death.

Fumigants are another popular form of control. In most cases they possess anæsthetic and asphyxiating properties, which act very rapidly on the vitality of the insects, causing paralysis, and if the insects are forced to remain in this atmosphere they soon die. Fumigants to be used successfully must be used intelligently. For instance some, such as carbon bisulphide, are heavier than air and must be released above the insects which are to be controlled; others such as hydrocyanic acid are lighter and must be placed in such a position that the rising fumes will overpower the insects and cause their death.

Soil fumigation is one of the surest means of dealing with the greyback cane grub, in that the pest is attacked at the place where it will cause its greatest damage, and if fumigation be carried out whilst the grub is still in its early stages, the cane stool will suffer very little injury. In Queensland, it has been customary to use a mixture of carbon bisulphide and paradichlorbenzene as a fumigant for the control of the cane grub. This fumigant is injected into the soil by means of a Dank's or Vermorel Injector, a measured quantity being injected at each stroke of the plunger which is operated by pressure with the hand.

BIOLOGICAL CONTROL.

The forces of nature if left to themselves tend towards a state of balance, and no one plant or animal can continue to increase in over-whelming numbers for any great length of time. If an insect pest increases abnormally over a number of years, a host of forces attack it from all quarters, and soon reduce it to its former status. These forces consist in adverse weather conditions, diseases, parasitic and predaceous insects, birds and animals, etc. Man has no control over some of these forces, such as the weather conditions, but he is able to utilise some of the other agencies in the control of certain pests which have increased abnormally in different parts of the world. This form of control is usually referred to as "biological control" and is applicable chiefly to the control of foreign pests which have accidently gained entry into another country. Under such circumstances it is usual to search for the death factors which keep the insect in check in its original home, and having selected the parasite or parasites which are considered to be the most effective, these are bred artificially, freed of all hyperparasites, and introduced into the country where the pest is to be controlled. Biological control is an ideal form of control in that friendly organisms aid in the suppression of the pest without any concerted effort on the part of man other than that of providing suitable conditions for the develoment of the parasite. This form of control is most successful in insular areas such as Hawaii and Fiji, where the fauna is limited and where introduced insects are not subjected to attack from a vast array of hyperparasites, etc., with which they might have to contend in larger continental areas carrying a larger and more varied insect population. In Hawaii, the control of the sugar-cane leaf-hopper and the Anomola grub have been outstanding successes in biological control when other forms of control seemed futile and the sugar-cane industry of these islands was threatened with imminent extinction. These cases were amongst the earlier attempts to utilise biological control, and their brilliant success has done much to popularise this form of control. In more recent years the spectacular control of the Levuana Coconut Moth in Fiji, by a fly originally parasitic on the caterpillar stage of a closely related moth in the Federated Malay States, has been one of the greatest achievemnts in the biological control of an insect which threatened the existence of the coconut industry, and which defied almost all other means of control.

Within our own industry we have an excellent example of biological control in the suppression of the sugar-cane beetle borer by the Tachinid fly parasite. This borer pest, which is a native of New Guinea and the neighbouring islands, gained entry into Queensland in the early settlement days when the sugar industry was being established. At that time indiscriminate introductions of cane were made from other countries without adequate quarantine restrictions, and it was in this way that the pest became established. In their native New Guinea the sugar-cane and its parasite had been associated for centuries and had attained a state of adjustment in which there appeared to be no danger of the pest increasing to such numbers as to become a serious menace to its host. On the other hand it quickly became apparent that in some of the wetter districts of North Queensland the borer, unless controlled in some way, would soon prevent the growing of all canes of the desirable soft, sweet types.

In seeking for a means of controlling this pest it was therefore natural that a search should be made for the probable parasites which restricted its numbers in New Guinea. This search was largely directed by the late Frederick Muir of the Hawaiian Experiment Station and soon led to the introduction of the Tachinid fly into Australia. This parasite has since been

bred in large numbers by the Entomologists of the Bureau of Sugar Experiment Stations and has been liberated by them wherever the beetle borer has been found, and it now exercises a high degree of control over that pest where climatic and other conditions are favourable.

However, these brilliant economic successes do not present the whole picture of biological control of insect pests. In this phase of endeavour, perhaps more than any other, the path to successful achievement is strewn with the remains of optimistic attempts which have ended in abject failure. Biological control does not consist in rushing off to a foreign country, bringing back a number of parasites, and letting them loose upon the unsuspecting pest; to ensure the success of biological forms of control a whole complex of factors must be inter-dependently favourable. Such a project is not to be embarked upon light-heartedly, but only after the most mature consideration, since a false step may have most disastrous economic consequences through the upsetting of the whole biological balance. Therefore we will now review some of the conditions necessary for the effective operation of biological forms of control and, equally important, some of the reasons why it cannot be universally applied.

It will be evident that a parasite cannot entirely destroy its host (i.e., the species on which it completes its development) for with the gradual elimination of the host, and the increase of the parasite, a point is ultimately reached where the number of parasites is greater than the remaining hosts, with the result that many parasites fail to find a host for the development of their young, and these die without reproducing. Consequently a reduction in the number of parasites soon follows a reduction in host population, until there is reached a point of partial equilibrium whereat the pest does not increase greatly before a corresponding increase takes places in the number parasitised.

The limiting factors operating against the successful working of a parasite may be a question of climate, or the kind of crop infested by the pest, and upon this latter factor depends the parasite's ability to locate its host. In the large continental area of America over which the Japanese beetle has spread, we find that in certain districts a wasp parasite is the most efficient of the many introduced species, whilst in other parts a fly parasite contributes largely to its control. Reverting once more to the parasite of the beetle borer, we find that this fly is able to exercise its greatest degree of control in erect cane, whilst in cane that is lodging badly the fly is unable to penetrate the dense layer of trash in search of borer grubs, and therefore control becomes reduced. It is also interesting to note in this connection that Veitch found the parasite to work very efficiently in the rainy districts of Fiji, whilst in the drier zones of the same island colonies of this fly parasite, which resulted from similar sized liberations, almost invariably died out. In Queensland we find that this parasite is favoured by similar conditions, and it is well established in the moister districts such as Babinda and South Johnstone, whilst its establishment in the drier areas has been more difficult and less permanent. During the coming years, it is proposed to attempt to overcome these difficulties by liberating many thousands of these flies in borer-infested localities; data will be collected on subsequent control, and in this manner it is hoped to gain a clear idea of the degree of control that can be expected, and to evaluate the limitations of the parasite under varying conditions.

Biological control of army worms is also an important illustration to Queensland growers, especially in view of the fact that from a knowledge of the degree of parasitism being suffered by the pest they are advised whether it is considered justifiable to bait the pest, or whether to take no further

steps other than to allow the infestation to be cleaned up by parasites in the normal way. In certain seasons (for instance, 1932 in South Queensland) the pest has been very bad, and has threatened to ruin young ratoons wherever trash was conserved. In this particular year the droughty weather and the harsh winter had adversely affected the parasites, and the pest was able to breed up in large numbers practically unmolested. In late October the parasitism suffered amounted to only 10-15 per cent., and consequently bran poison baits had to be used to check their depredations. Hence the limitation of parasite control under a certain set of conditions will be apparent. However, during the past year in the same areas, larger fields of trash have been conserved, but a milder winter has been followed by a more rainy spring. Army worm damage has been very light—certainly insufficient to warrant extensive artificial control measures being instituted against them, and the parasites have been able to cope with the pest in an entirely satisfactory manner.

The most recent attempt of the Bureau to bring about biological control by means of introduced parasites has been directed against the Isis cane grub in South Queensland. For this purpose a Dexiid fly has been introduced from Canada on two occasions during the past two years. In Canada, this fly normally attacks a grub very closely allied to our cane pest. Small isolated fertile areas, such as the Isis district, surrounded by tracts of less fertile forest country, and which carry an insect fauna totally different from the surrounding one, have been likened to islands and are termed biological islands. It is thought that an introduced parasite, if once established, might become more efficient under such circumstances and less liable to suffer attack from insect parasites than if the same insect were introduced into a large continuous belt of similar country, carrying a varied insect population, and where it might be subject to attack from many quarters. Hence, one of our reasons for attempting to establish the Canadian Dexiid in the Isis district. Conditions for the liberation of this Dexiid were not however satisfactory, since drought conditions prevailed during 1931-32, and during 1932-33 host grubs were relatively scarce. It is yet premature to attempt to ascertain whether the parasite has become established or not, since very few of such initial liberations show definite results for some years, but this liberation will be watched closely and collections of grubs will be made periodically to ascertain if the parasite is actually breeding in this new locality. With regard to the time taken for a parasite to become effectively established, an extreme case is on record where a parasite introduced into America to control a certain fly pest was apparently ineffective, and was not recovered for twenty-one years after its liberation, but at the present time it is regarded as the most efficient natural controlling agent of this pest.

In the case of the "greyback" cane grub, the hope of attaining any appreciable increase in parasitism by the introduction of a foreign parasite does not appear very promising in the light of our present knowledge of the pest. This insect is indigenous to Queensland, and in its natural state the grubs fed on the roots of native grasses and other plants more especially in "scrub country." With the planting of these fertile jungle areas with sugar-cane, the greyback has been favoured with a set of conditions pre-eminently suitable for its wholesale multiplication, and it is now found in pest proportions from Mossman in the north to Carmila as its southern limit. Thus, the area covered by this pest, in contradistinction to being of the biological island type, is more truly of the continental type; and in this large expanse it is attacked by a considerable number of natural parasites, which in their turn are kept in check by hyperparasites, rendering them more or less ineffective. Hyperparasites are not, as a rule, specific, and they would in all probability turn their attentions to any new importations we might make,

and render them equally impotent. Further, since there are no overlapping generations, and the period of activity of any one of the stages in the life cycle of the greyback is relatively short, it is probable that an introduced parasite would require an alternate host to maintain it throughout the corresponding period of its cycle when grubs are not readily accessible. This necessity for an alternate host is considered to be a distinct disadvantage, since the parasite would then divide its activities between two or more species of grubs, rather than concentrate on the one pest whose numbers we wish to materially reduce. However, this side of the question will be further investigated with a view to discovering any circumstances which might justify our proceeding with such a desirable form of control.

Hitherto we have dealt with biological control from the point of view of control by insect parasites, but it is well to remember that diseases often take heavy toll of dense insect populations. These diseases are, however, rather unreliable, and are usually dependent for their wholesale development upon a set of favourable weather conditions. Birds, too, are generally regarded as being of great assistance to man in keeping down his insect enemies, and one has only to watch a flock of ibises following behind ploughs and ridding the land of soil-frequenting insects to be convinced of the numbers they are able to destroy. Crows also are assiduous grub eaters, but in some seasons when food is plentiful they are somewhat diffident in following the ploughs. Other smaller birds often show a decided preference for the smaller parasites and predaceous insects, and their importance as grub destroyers appears to have been overrated in certain instances. In the West Indies, the giant toad, *Bufo marinus*, is believed to exercise a very appreciable degree of control upon the beetle stage of "white grubs." This animal has recently been introduced into Hawaii and we are watching its activities closely with a view to its introduction into Queensland.

LEGISLATIVE CONTROL.

Legislative control is preventive rather than remedial, and the institution of a strict quarantine aims at preventing the importation of foreign pests. Although most of our serious sugar-cane pests are native ones which have turned their attentions to cane, a notable exception is the sugar-cane beetle borer, which originally came from New Guinea, and we might well ask ourselves how much better off some individuals might be if they were not embarrassed by the presence of this pest on their farms. Other important pests are to be found in nearby sugar-producing countries, but these we fortunately have not yet acquired. However they remain potential sources of danger if attempts are made to evade the State quarantine regulations, or if the indiscriminate introduction of new varieties were permitted. With the quicker modern methods of transport, and the extended use of aerial travel, the chances of foreign pests being imported into Australia appear to be considerable, despite the existence of rigorous quarantine restrictions, and if some of these pests became established our sugar industry might suffer serious losses before they could be brought under effective control. Again, some of our resident pests have not yet succeeded in becoming established throughout the whole of the sugar districts of Queensland. Whether this was due to previous unsuitable conditions, or to the happy circumstance that none of these pests were ever introduced into clean areas with the exchange of planting material, is more or less a matter of speculation at the present time. However, with the extension of irrigation in some of the drier belts, and the consequent production of larger crops, uncontrolled interchange of plants might easily result in the spread of some of these pests to areas far beyond their present limits, now that conditions in these latter districts appear to be more suitable for their establishment. To guard against any

such occurrence, inter-district quarantines have been established, involving eight major districts, and a proclamation has been issued prohibiting the removal of cane for planting purposes from one major district to another, unless under permit from the Bureau of Sugar Experiment Stations. In order further to discourage the transport of varieties from one district to another there has recently been enacted an amendment to the Cane Prices Act whereby there is required to be published each year a list of the varieties which are approved for each mill district, all other varieties being automatically disapproved and subject to penalties. This amendment is intended to remove the incentive for variety fanciers to collect canes from all over the State, a practice which has already had the most serious consequences in spreading diseases to new localities.

Such laws are of little avail unless they are backed up by a well informed and well disposed public opinion. The spread of insect pests constitutes a real danger, and all growers and others interested in the welfare of the sugar industry should accord their sympathetic co-operation in the enforcement of any measure aimed at pest restriction.

PULLING OUT FENCING POSTS.

This illustrates a method of pulling out fence posts. This fulcrum, having two legs, stands firmly on the ground, with the top against the post which is to be pulled out. The horse can pull a dozen times without the position of the fulcrum being affected. Having a lean against the post, it makes the task of lifting the post easy in every way, and lighter on the horse. The fulcrum should be about 4 feet long,

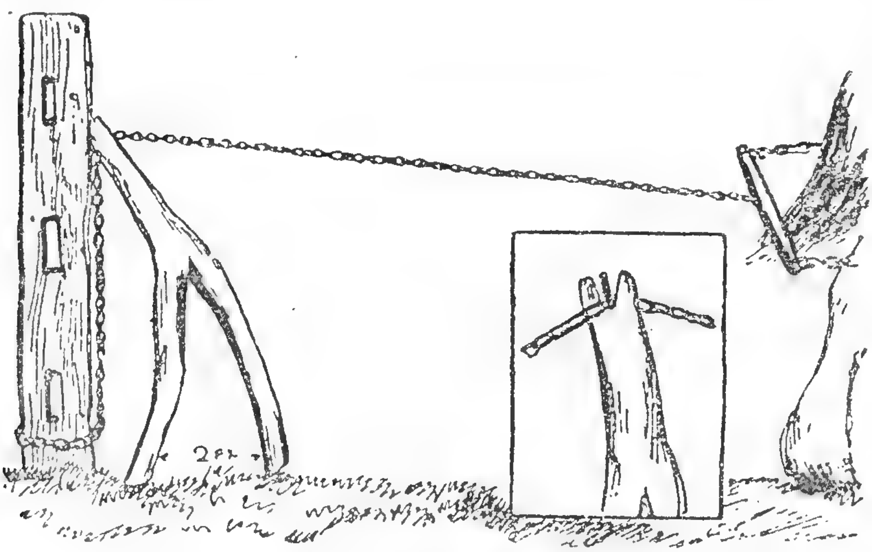
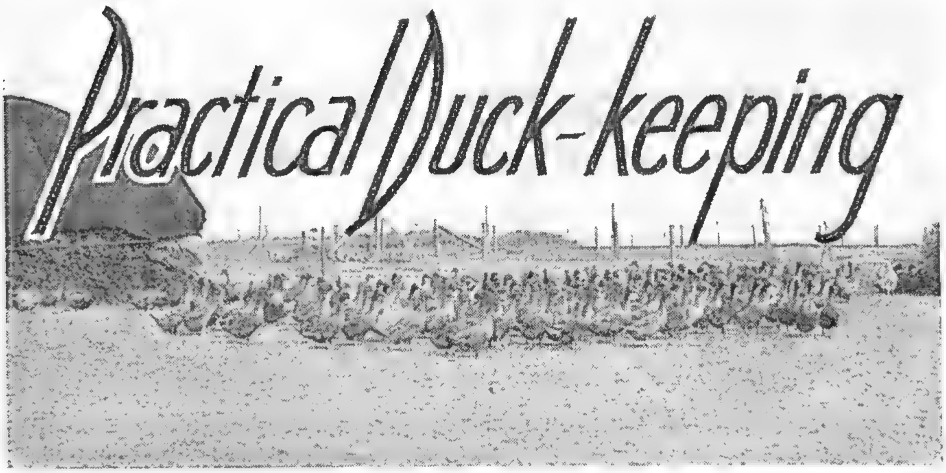


Plate 85.

and it is all the more effective if it has a bend. The two bottom ends should be about 2 feet apart, and placed, say, 2 feet 6 inches from the post. It is advisable to cut them so that they will hook into the ground, and not slip. A V should be cut in the top of the fulcrum and a pin inserted without a head, so that it will fit into any link of the chain, which should be made as tight as possible between the top of the fulcrum and the bottom of the post. Aided by this contrivance a man, with a good horse, can easily pull out a mile of fencing a day.



By J. J. McLACHLAN, F.B.S.A., Poultry Inspector.

IN Queensland, ducks are chiefly kept for table purposes, although quite a number of small flocks are kept for egg production. There are very few specialised duck farms; the usual practice is to keep a flock of ducks as a farm sideline. The market for table birds is usually kept fairly well supplied from existing sources, high values are therefore not regular. Reasonably high prices are, however, obtainable when the demand is firming for the Christmas trade. This fact indicates the necessity for a continuous supply of cheap foodstuffs suitable for growing ducks destined for the table. The keeping of ducks for egg production is not practised extensively in this State; this is possibly due to the unpopularity of the duck egg, making it somewhat difficult to market. It is all a question of taste, for a duck egg is equal to a hen egg in food value, and, provided the birds are fed on good wholesome food and kept under strict sanitary conditions, it would be fairly difficult to distinguish any difference in general quality. Ducks are more prolific layers, have a longer profitable life, are more easily reared, and are freer from disease than other poultry.

The foremost breed is the Muscovy; this bird is essentially a table bird, and may be found all over the State. The Muscovy is distinct from all other breeds of ducks and will always remain distinct, for if this breed is crossed with any other breed of ducks the progeny will be mule ducks.

THE MUSCOVY.

General Characteristics.

The head is large, and at times it raises the feathers in fan shape; the beak is thick, with a band of reddish colour, the nostrils and the face being covered by caruneulated flesh; the eye is brown; the neck is thick and of a fair length. The body is a great frame, rectangular in shape and nearly horizontal, short and powerful in leg, with fairly large feet, webbed to end of toe, with powerful claws. The male has no curled feathers in the tail, as other breeds; his plumage is of a brilliant bronzy black, with a green sheen. Legs of both sexes are black to the toes.

The female is similar to the male, but only half the size, without the wrinkled flesh around face, and duller in plumage than the male.

Plate 86.—A Typical Muscovy Duck.

Size.

The average weight of the drake is just over 12 lb., but many reach 14 lb. and over. The duck, however, is less than half the weight of the drake, and it is a very large duck which attains 6½ lb., the average being about 5 lb. The adult drake is enormous—measuring frequently 32 to 34 in. in length; it walks slowly and heavily.

INDIAN RUNNER.

General Characteristics.

Of the egg-producing ducks, the Indian Runner predominates in numbers. But the Khaki-Campbell is becoming very popular and is equal as a layer, whilst it is slightly heavier in body weight than Runners.

Head.—Fine and somewhat flattened over the skull, with the eyes full, bright and clear, showing alertness, and situated high up in the skull. Bill strong and deep at the base where it joins and fits almost insensibly into the skull, and thence comes as nearly as possible straight down to the tip, giving it a wedge-shaped appearance, of good average length.

(*Note.*—The shape is more important than actual length or width, and it should be proportionate to the build and size of the bird and well set into the head at the junction. Very flat or dished bills with rounded under-line are objectionable, and abnormally long heavy bills are liable to be accompanied with coarse heads and thick necks, which are serious faults.)

Neck.—Neck very fine, thin and slender to where it begins to form the expansion towards the base of the neck, which expansion should fit almost insensibly into the upper part of the body, so as to appear almost part of it, the head and neck carried high and slightly forward, and not curved or carried swan-like.

Body.—Body—the lower portion of the neck expansion is included—long and narrow, of nearly uniform thickness, very tightly feathered.

Wings closely packed; approximately about twice the length of the neck to the top of the head. When standing erect, the stern appears comparatively short and curves round to the tail, which is close and neat, and in the best specimens carried nearly in a line with the body, but in some excellent birds it is slightly elevated or turned upwards, and a fullness of the lower stern is frequent in the most prolific layers.

Legs.—Legs placed much farther back than in other breeds of domestic ducks. Shanks comparatively short, with small supple feet and strong thighs to enable the bird to balance properly and maintain an upright position when on the run.

PLATE 87.—WHITE INDIAN RUNNER DUCK.
Note upright carriage which is characteristic of this breed.

Length and Size.—As layers of a great number of large eggs, substance and constitution are necessary in the breed; small, square specimens are useless, while heavy bulky birds are less active as foragers

and open to the same objections. A medium size with good reach and perfect symmetry is advisable, but appearance and activity should be a truer guide than actual weight and measurements.

Carriage.—In comparison with other ducks, the body is more tightly feathered and appears longer and thinner, and this impression is heightened by the remarkable erect carriage and the fact that the bird when on the alert carries its neck and body almost in a line at an angle of from 50 to 70 degrees to the horizon. Its gait is peculiar in that it travels with a straight-out run and does not waddle or roll like the ordinary duck. In general appearance and shape when in motion, it has, not inaptly, been likened to a soda-water bottle set at an angle of 50 to 60 deg., a character which is best seen in a front or semi-front view. When startled, standing at attention, or trained in the show pen, it assumes an almost perpendicular pose or attitude.

Weight.—Drakes, 3½ lb. to 5 lb.; length 26 inches to 32 inches. Ducks; 3 lb. to 4½ lb.; length 24 inches to 28 inches. The above are fair standard weights and lengths, but must count for nothing if not accompanied with type and well-balanced proportions.

There are three varieties—Fawn, Fawn and White, and the White.

THE KHAKI CAMPBELL DUCK.

General Characteristics.

This is a moderately small breed, the body being wide and fairly deep, with slightly upright carriage and finely-shaped head and neck. In the male the bill is green (the darker the better), the head, neck, stern, and wing-bar bronze, and the rest of the body an even shade of

PLATE 88.—A KHAKI-CAMPBELL DRAKE.
A Prolific Laying Breed.

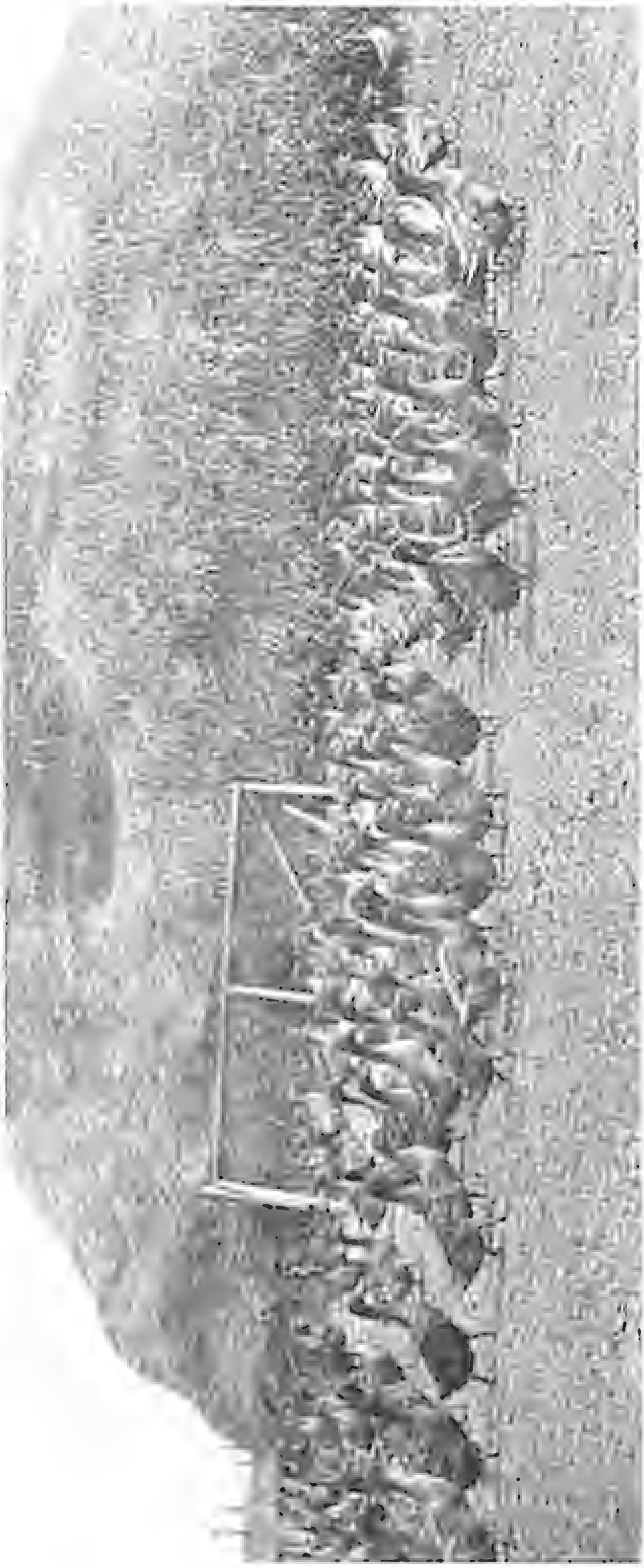


PLATE 89.
A flock of Khaki-Campbell Ducks on a Victorian farm.

khaki or dark buff, with dark orange legs and feet. In the female the bill is greenish-black, the plumage being khaki or dark buff all over, with even ground colours while the back and wings are laced with a lighter shade of buff, and the legs are dull orange, both bill and legs being several shades darker than in the drake. Lightish feathers in the wings are allowed, but white bibs are untypical, as are yellow bills. Khaki Campbells are tame and tractable creatures, and prolific layers of white eggs.

Weight—both sexes, $4\frac{1}{2}$ lb.

HOUSING.

The mild climatic conditions in Queensland obviates the necessity for the construction of elaborate or costly houses for the accommodation of ducks. That does not mean that ducks can be herded profitably into any class of a house. Houses should be built similar in design to ordinary poultry-houses, a lean-to building facing north or north-east, open-fronted, with a ventilation space at the top of the back wall. Buildings so constructed will afford the ducks most protection against prevailing winds and rains whilst at the same time the sun's rays penetrate into the house.

Construction.—The building need not be deeper than 5 feet, and the roof could be 6 feet high at the front and 5 feet high at the back, and a ventilation space of 3 inches at the top of the back wall would be satisfactory. In estimating the size of the building, allow 2 square feet of floor space for each duck; thus, a building 10 feet long and 5 feet deep will accommodate twenty-five ducks. The best materials for the construction of duck houses is sawn hardwood and galvanised corrugated iron. Some persons may desire to make use of bush saplings so as to have cheaply constructed buildings; this may be done, but it is essential to have an iron roof. It may be thought that as ducks usually camp out in the open it is unnecessary to have an iron roof, but this is absolutely essential, for one of the most important factors in the housing of ducks is a dry floor.

Floors.—It is essential for the floor of the house to be dry at all times; a damp or wet floor in a duck house may cause many deaths among the flock, while practically the whole flock will receive a check in growth or production. To ensure dry floors, build up the floor at least 4 inches above the level of the surrounding land; also excavate drains on the highest side of the house, so as to carry away storm water. Concrete floors are best, but an earth floor that has been tamped down fairly hard will be satisfactory. To facilitate cleaning, cover the floor with coarse sand or a litter of hay, grass, or straw. The litter will act as a bedding for the ducks. Nests should be provided. These may be placed on the floor against the walls.

BREEDING.

It will be found most profitable to adopt the same breeding season for light-breed ducks as generally adopted for other poultry—namely, June to September. Ducks hatched during these months will commence laying when egg values are high, and continue for about twelve months before moulting. Heavy breeds hatched during June, July, and mid-August, will be more profitable, as they can be marketed in prime condition for the Christmas trade. The breeding of heavy breeds may be

continued throughout the year, providing that a constant supply of cheap suitable foodstuffs is available.

Selection and Mating.—Care must be exercised in the selection of breeding stock. Special attention must be given to type and size. A careful study of the description of the breed is necessary, so as to be able to select birds that are reasonably true to type. Ducks have a tendency to deteriorate very rapidly in size; therefore, it is essential to maintain size of body when selecting breeding birds. In this regard, it is good policy to weigh the birds before placing them in the breeding pen. Defective ducks should not be used for breeding purposes. In mating, the number of females to mate with each male varies with the age of the male, size of run, whether the birds have access to a swimming pool, and the breed. On an average, mate between six and eight females with each light-breed male, and from four to six females with each heavy-breed male. The number of females may be increased if the male is young and very vigorous. Ducks may be safely bred from until they are three or four years old.

PLATE 90.
The proper way of holding a duck.

MANAGEMENT.

Ducks should be kept apart from fowls, as they are greedy feeders and often prevent the fowls from obtaining sufficient food. Their way of feeding is also slightly different. Apart from these factors, ducks make the drinking water unsuitable for poultry. A swimming pool is not a necessity, but where ducks have access to a pool, they keep in better health, their plumage is cleaner, and they are more free from external parasites. In addition, a higher degree of fertility results if breeding birds have access to a swimming pool. As the duck usually lays in the night or early morning, it is necessary to confine them to the run or house until about 9 a.m., otherwise many eggs may be laid in the pool.

Ducks must have a constant supply of clean, cool, fresh water, and when confined during the night water must be supplied. The water

Plate 91.

A flock of Muscovy Ducks on a creek at Enoggera, Brisbane.

vessels should be deep enough for the duck to submerge its head in the water.

Ducks are naturally clean in their habits, but if confined in a small enclosure not properly drained, filthy conditions will result. Therefore, strict sanitation should be practised.

When kept in large numbers, ducks, particularly Indian Runners, are very excitable and easily frightened, and if frightened they are very liable to go into a partial moult.

INCUBATION.

It is the usual practice not to set the first batch of eggs laid by a duck, these being often infertile; also, if fertile, weak ducklings usually result from such eggs.

The period of incubation is 28 days for all breeds with the exception of Muscovy eggs. These take 35 days to hatch. The incubation of duck eggs is best done with ducks. If broody hens are used, it will be necessary to sprinkle the eggs with water regularly. Also sprinkle water on the ground close to the nest, for when the hen comes off she will dust-bath, and her feathers will be moistened when she returns to the nest. The duck, however, will moisten her feathers sufficiently before returning to the nest. With artificial incubation, the temperatures should be about 1 degree lower than that for hen eggs—namely, 102 degrees. After setting, the eggs should not be disturbed for 48 hours. After this period they should be turned twice daily, and cooled daily. Each time the eggs are turned, before being returned to the machine they should be sprinkled with warm water. This sprinkling is essential, because the eggs require a lot of moisture. Test, and remove all infertile eggs. Do not open the machine after the ducklings commence chipping until the hatch is complete. Ducklings take longer to break out of the shell than chickens.

REARING.

Ducklings are very hardy, and easy to rear, therefore rearing may be done by artificial methods. Any type of a simple brooder that will permit of water being kept within access of the ducks will prove satisfactory. For instance, a frame with four legs about 6 inches high to which is tacked a piece of hessian from which flannels hang to within an inch of the ground will give results. First place ample straw on the floor, put down the brooder; the ducklings should be kept under the brooder the first day without food or water. To confine them, use inch netting close up all around the brooder. By adopting this practice they will know where to go when feeling cold. The following night they may be allowed 8 or 10 inches around the brooder, and in this space place water vessels. After about a week, it will not be necessary to confine them to the brooder. After about three weeks the brooder may be removed, providing that ample straw is placed in the shed. One important point must not be overlooked, and that is ground draughts must be prevented. Every day the straw should be forked up and, if necessary, replaced with clean, dry straw. Ducklings must not be crowded; best results will be obtained by rearing ducklings in small units. When about four weeks old they may be placed out in houses, for they do not then require much attention apart from plenty of food and water. Ducklings should be protected from the hot sun until

they are well feathered on the head and neck; this is more important with Indian Runners than other breeds. Therefore, the rearing pens should have a number of shade trees growing in them; if not, artificial shade must be provided.

FEEDING.

Ducklings require no food for 48 hours after hatching. During this period they could be supplied with water, coarse sand, and charcoal or wood ashes. A mash that will give good results if fed from the first meal until they are about four weeks old is prepared by mixing together pollard, 10 lb.; maizemeal, 8 lb.; dried buttermilk, 2 lb.; bonemeal, ½ lb.; and fine salt, 2oz. If these ingredients are mixed together the amount for each meal may be moistened as required. If available, 3 lb. of curds would replace the dried buttermilk, thus cheapening the ration. Skim milk is excellent for ducklings; it can be used to moisten the mash, but do not give it in the form of a drink. If there is ample milk available, allow it to curd and strain off the whey, then feed the curds. Imitate nature as far as possible by giving several small meals daily to young ducklings. A little and often is a good motto to adopt. After four weeks of age, they may be fed on a similar ration to the mature ducks. When mature it is only necessary to give them three meals daily, supplying as much food as the ducklings can consume in about half an hour. Be sure they have a big evening meal.

Plate 92.
Ducks should be caught by the neck.

A ration that will give excellent results for the feeding of mature ducks is comprised of the following ingredients:—Pollard, 55 lb.; bran, 25 lb.; maizemeal, 10 lb.; meatmeal, 10 lb.; bonemeal, 1 lb.; and fine salt, 1 lb.; to which may be added 25 per cent. of cooked vegetables or chaffed greenstuff. The salt should be mixed in the liquid first, so as to ensure a thorough incorporation in the mixture. At least two meals should be given daily, but with mature birds a small meal of whole maize may be fed in addition to the mash.

For the fattening of ducks, consideration must be given to the availability of cheap foodstuffs, which are often obtainable in the form of potatoes, pumpkins, and other vegetables; these should be boiled and

may be added to the mash upwards to 40 per cent. of the bulk. Chaffed greenstuff should be included, but do not use much greenstuff when making use of a large proportion of other cheap foodstuffs, otherwise the mash may be too bulky.

Always keep a supply of shell grit and coarse sand in receptacles before the birds.

WATER.

Water is one of the biggest factors in successful duck-keeping; they must always have access to ample clean, cool, fresh drinking water. The water vessels or pool should be sufficiently deep to permit the ducks to submerge their heads. The water vessel should be kept under a shade tree or protected from the sun by providing artificial shade. In rearing ducklings, it is a good plan to put a number of stones in the water vessels; this prevents the ducklings swimming and wasting the water.

Water vessels should be constructed so the ducklings can get out easily in the event of their swimming in the vessels, otherwise they may drown through cramp. This cramping is more likely to occur during cold weather.

COMMON TROUBLES.

As stated previously, ducklings are hardy and easily reared, but losses will occur if they are neglected. The most common troubles are chills and staggers.

Chills.—Symptoms—Watery eyes and nostrils. Cause—Wet or damp sleeping quarters.

Remedy—Keeping the floors dry is the most important point. The drinking water may be slightly coloured with permanganate of potash, and changed several times daily.

Staggers.—Symptoms—Ducklings stagger about and fall on their backs before dying. Cause—Lack of water. When water is supplied after there has been a shortage, the ducklings gorge themselves, bringing about this condition.

Remedy—Keep a constant supply of drinking water before the ducklings.

WHEN SENDING SPECIMENS—NOTICE TO READERS.

With every mail numbers of letters are received from readers requiring advice on matters affecting their crops, stock, &c. Many of these letters are accompanied by specimens about which information is desired. Much trouble would be saved if the sender of each package clearly marked his name and address on the outside. Often the only means of identifying specimens is by a comparison of the handwriting on the address with that on the letters received. Letters should not be enclosed in packages, nor should packages be sealed in such a way as to prevent examination by the postal authorities, for in such cases postage is charged at the letter rate of 2d. per ounce, and the Department of Agriculture and Stock has to pay double the deficiency.

Flocks and Fleeces.

By J. CAREW, Senior Instructor in Sheep and Wool.*

WITH the sheep and wool industry is wrapped up the progress and prosperity of Queensland. Vast tracts of our Central and Western territories are so well adapted naturally for depasturing sheep that the highest quality of merino wool is produced on country where the range of regional rainfall is only from 12 to 20 inches annually, and with no other land improvements than water provision and fencing. In this country, and under the conditions prevailing, the Merino finds its home, and it is the wonderful adaptability of the breed to its territorial environment that has made it the most important factor in the economy of the State.

Where sheep are to be run on grass alone, under the conditions that prevail in our far inland areas, this breed has no superior and we cannot do better than foster its improvement and increase its numbers.

Queensland merino wool has earned a great reputation for the general quality and fineness of its fibre; and, as it fulfils all the requirements of a constant and strengthening market demand, every endeavour should be made to eliminate any coarseness of type not characteristic of the pure Merino. Other countries can produce breeds other than the Merino and that carry coarse wools. It would be to our advantage to avoid competition in wool production in these types, especially in our Central and Western areas. Where sheep are associated with agriculture, the Merino can also be utilised, but in a different way and to a more limited extent. In every country where sheep have been introduced it has been found that some breeds thrive and do better than others. In caring for the breeds that had done best, they were found to develop under the change of environment special characteristics either in type, conformation, constitution, or covering.

British Breeds and Crosses.

The most interesting instances of improvement in breeds and types may be observed in the British Isles where about thirty breeds have been evolved. Each breed is distinct in formation, size, and character; as well as in the length and colour and quality of its wool. Very few distinct breeds were first introduced into Britain, but by crossing to suit special environmental conditions and sticking to the type evolved they developed a set breed. By careful selection, these breeds have been maintained true to type for years. They are chiefly associated with agriculture and adapt themselves more successfully to cultivated crops than the Merino. Many of the British breeds have been introduced into Australia, and those which have done best have also been brought into Queensland chiefly for crossing with the Merino. In this respect they have been very successful, but we shall have to continue introducing them unless studs are started here.

As the Central and West is suitable for breeding the Merino, so is the Darling Downs and similar areas suitable for breeding both the English long-wools and Downs breeds. The chief points leading to success if the sheep are kept under congenial conditions are that they are kept in good health and properly fed. This is a matter requiring forethought and judgment. Where the annual average rainfall is between

* In a broadcast from Radio Station 4QG.

20 and 30 inches, it should be possible to grow a fair quantity of fodder crops for fattening purposes and for conservation. Under these conditions these English breeds can be reared successfully and studs established. Only sufficient stud flocks would be kept to replace the wastage in the sires required. All the drop not selected for this purpose could be disposed of as lambs for home consumption or export. There would be no necessity or advantage in taking any of the strains of the British breeds back into the merino country. In present circumstances, the expansion in production of many crops that can be grown successfully on the Downs, and closer in to the coast, cannot be done profitably unless a greater number of stock are raised and sold on the hoof.

I consider that the greatest opportunity for agricultural expansion is offered in the breeding and fattening of lambs for export. For this purpose, the whole of the progeny of all Downs crosses could be sold at about four and a-half months. The Downs breeds will cross well with the Merino, but in this respect the best results could be expected by using the stronger type of plain-bodied ewes. Where the English long-woolled rams are used, all the ewe progeny could be retained for breeding purposes. The Lincoln, Border Leicester, and Romney Marsh have already proved themselves satisfactory for this purpose in Queensland. The less Merino and more Romney Marsh near the coast will be the strain to suit the conditions. Further inland, and for higher and better-drained conditions, the Lincoln and Border Leicester, especially the latter, is to be preferred.

The progeny of the long wools are not as quick to mature and fatten as the Downs crosses, the Border Leicester excepted.

The Farmer's Breeding Flock.

The ideal type of farmer's breeding flock is a quarter-bred long-wool three-quarter-bred Merino. This type is strong and robust, well adapted to stand adversity, and make a good recovery; and they can be mated both in autumn and spring. Their wool is usually of a good, desirable type, an important point in a flock that has to be maintained from year to year. If the breeding flock is retained for about five years, they should then fatten successfully. It is far more profitable to fatten the breeders off before they become too old, for it is among aged sheep that heavy losses occur.

All countries have their seasonal difficulties, and Queensland is no exception. There are periods when little or no provision, other than that provided by nature, is necessary; and this is, to some extent, responsible for the lack of provision by most of our sheep farmers.

Successful fat-lamb production must follow the plough. Fortunately for us, we can produce successfully in normal seasons both summer and winter crops in all districts suitable for the English breeds of sheep and their crosses. Health is another matter of great importance, but fortunately we have no parasite or disease here but what can be successfully dealt with. The ordinary stomach worm is the one parasite in our agricultural areas that causes the greatest amount of trouble, and these are extending well out to the West.

Drenching and Dipping.

Too much care cannot be exercised when introducing sheep on to a holding, and if there is any suspicion of worms they should be drenched twice at intervals of eight days.

In recent years lung worms have been causing considerable trouble, especially in the southern part of the Darling Downs. The introduction of stud sheep from lung worm areas in the South is, to a great extent, responsible for this spread, for very few store sheep cross the border. Chiefly because of the probable introduction of parasites and diseases with imported stock, I advocate the establishment of a small stud by the farmers themselves. The blowfly is a pest that causes enormous losses to the pastoral industry every year, and the sheep that carry other parasites are more prone to fly attack than healthy sheep. Sheep lice and ticks are parasites that also cause considerable irritation to the sheep, and consequent loss of flesh and wool. By drenching with suitable drenches for the ordinary stomach worms a big protection is given to the sheep against lung, tape, and nodule worms, besides improving the health of the flock, which enables them to resist the attack to a far greater extent.

By dipping all sheep in a good, reliable dip about six weeks after shearing, both lice and ticks are practically controlled for the year. A second dipping will be necessary if a liquid dip is used. Where arsenic is incorporated in the dipping mixture, a considerable benefit will be derived as a protection against the blowfly. If flies are prevalent at the time of dipping, large numbers will be destroyed. If rain occurs within a few weeks after dipping, the flies generally get busy on the damp wool, with the result that more of them will be destroyed. In fact, dipping pays the sheep farmer well where the need exists for protecting his flock against pests and diseases.

Scouring the Clip.

There are many systems of treating wool in the scouring process. Different makes of machines are procurable, but their use is out of the question when only small lots are to be treated.

The potsticks have been superseded by the wool-washing boxes. The latter requires a plentiful supply of water, which should enter in such a way as to keep the wool open and slowly revolving without becoming ropey. These boxes are made of wood, and big enough—about 3 feet square—to allow a man to reach all parts comfortably. Inside this box is a close wire or perforated zinc tray made to prevent the loss of small locks during the scouring process. A space of from 2 to 3 inches is allowed between these two boxes for the free passage of water. The outer wooden box is fitted with a valve for quick drainage. The water is supplied from an overhead tank and enters the box at the bottom, which keeps the wool open while the box is in use. For convenient working there should be two soak tanks and two washing boxes to be used alternatively. The two washing boxes are then filled with wool from the first soak tank. Between the two washing boxes should be a draining board sufficiently large to take the wool from one washing box. The wool is allowed to drain while the second box is washed and the first box refilled. This drained wool should be put into a centrifugal or hydro-extractor, for the sooner the wool is freed from water the better the colour. This outfit requires capital and a plentiful supply of water; so where small lots are to be treated tubs may be used both for soaking and washing.

The ordinary common bar soap will be found suitable to put in the soak tank, 1 lb. to 300 lb. of wool, which can be soaked in 200 gallons of water, or in like proportion. Caustic soda should not be used in scouring

wool, but matured caustic soda soap is quite safe. This can be made according to directions on the containers, but the larger the quantity the longer it will require to be stirred. The fat should be stirred well to ensure that it is all melted, and then allowed to cool down to lukewarm, or to when it commences to harden on the sides, before adding the caustic lye. After cutting into bars it requires at least six weeks to mature. To prepare it for use, dissolve 1 lb. of soap in 2 gallons of water by boiling, and use as required to make the liquor the desired strength. The water in the soak tank should be from 100 deg. Fahr. to 120 deg. The wool should remain in soak for at least half an hour. Vary the quantity of soap and the temperature of the soak liquor according to the nature of the wool. Dusty wools require more soap, less heat, and longer soaking than ordinary heavy-conditioned wools, such as locks and stained pieces.

Without the centrifugal, wool should be allowed about ten minutes to drain, then pressed to squeeze out all surplus water and immediately spread on hessian sheets 8 feet by 6 feet and left in the sun to dry. Treatment during drying is important, as all lumpy wool will dry a dull colour. To avoid this, hold the wool to the body with one hand and tease out in small handfuls with the other while turning it. While on these sheets the wool should be turned and teased out twice a day. When thoroughly dried, roll it up in the sheet on which it is spread and stack for a few days in a heap under cover. This allows the wool to become uniform in condition throughout.

Before scouring, the wool should be sorted into classes as even as desired to secure a product even in quality, length, colour, and condition Belly wool, stains, and locks should be kept separate.

QUEENSLAND SHOW DATES, 1934.

August.

Royal National, 6th to 11th
Home Hill, 31st August and 1st September

September.

Enoggera, 1st
Imbil, 7th and 8th
Ingham, 7th and 8th
Pomona, 12th and 13th
Innisfail, 14th and 15th
Mareeba, 20th and 21st
Beenleigh, 20th and 21st
Rocklea, 22nd
Malanda, 26th and 27th
Kenilworth, 29th

October.

Southport, 5th
Millaa Millaa, 5th and 6th
Tully, 12th and 13th

Part I.

E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

The Large White.

ORIGINATING in Yorkshire, England, and formerly known as the Large Yorkshire, the Large White, one of the best known of British breeds of pigs, has, in recent years, gained world-wide fame and popularity, and is now the most widely distributed of all pure breeds. Its history is full of interest, for it was one of the first of the breeds claiming origin in the United Kingdom to be developed and popularised, although in those early days it was not of the same excellent type and conformation as at present, nor did it carry the same breed designation.

Breeders not only persisted in their efforts to improve and commercialise the new breed, but at considerable expense to themselves exhibited at live-stock fairs and village stock shows. In this and many other ways they brought under the notice of farmers of the Homeland their importance as an influence in the breeding of a better type of animal. Progress in such work was necessarily slow and difficult.

For many years, particularly in Australia, this breed appeared to lose favour. The Large White has now regained its popularity, and has proved its adaptability and suitability to such an extent that it now holds pride of place in the pig world; and is represented in official herd books by a greater number of registrations than any other known breed, British or American.

Breed Characteristics.

The Large White is one of the largest of the British breeds of pigs, its long and abundant coat of white hair on a white or pinkish-coloured skin being characteristic, the pinkish-coloured skin indicating breeding and quality, while freedom from blue or dark spots on the skin is an important point. It would not be correct to say that the presence of one or two of these blemishes on the skin is an indication of lack of quality or purity in the breeding, for wherever white-skinned pigs are bred there is a tendency for blue or dark-coloured spots to appear, more particularly above the eyes or in the vicinity of the ears, with an occasional spot on the back or rump.

It is to the credit of the Large White that it has frequently been successful in winning bacon pig and bacon carcass contests throughout the world; that it is invaluable for crossing and is recognised especially for this characteristic. It is a recognised sire for imparting quality to stock which lack this very necessary qualification; it is excellent for bacon production, more particularly where crossed with blocky or thickset stock; it matures quickly and to advantage, and is recommended by curers and butchers, especially by those who are more conversant with the virtues of this type and its crosses with other breeds. It is universally recognised for all these qualifications and, while able to satisfy the varied requirements of the general agriculturalist in this and other countries, it is especially adapted for use in commercial pig farming under the open-air system, so desirable wherever pigs are kept in numbers sufficient to justify the outlay necessary in providing additional outdoor accommodation.

PLATE 93.

Large White Boar of approved type as recommended for use in the breeding of bacon pigs suited for local and export trade. Note sturdy appearance of this well-known sire.

The breed is exceptionally prepotent, in fact, both this and the Middle White have this desirable characteristic to a marked degree, and wherever the white breeds are used the bulk, if not all, of the progeny will be white in colour, and very true to type. Prepotency has been defined as the power one parent has over another in transmitting its qualities and breed characteristics to the offspring; thus the Large White as a sire transmits his qualities, type, and colour to a very marked degree when crossed with a blocky thick-set sow of, say, the Berkshire type. In its turn, the Berkshire, also a prepotent breed, gives a compactness and desirable conformation to the progeny, but fails to transmit its colour, because in that respect the white breeds carry a greater degree of prepotency. The reverse holds good also, for when the Berkshire boar is crossed with the Large or Middle White sow the majority of the progeny will be white in colour, though perhaps showing more of the Berkshire type than where the white pig is used as a sire.

Another desirable characteristic of the Large White is that of fecundity or prolificacy. It is not only an advantage to the farmer that his stock should breed freely and regularly, but that they should also reproduce themselves abundantly.

Fecundity as a breed characteristic and, particularly in the Large White, runs in families; hence within the breed there are many families more prolific and more desirable than others, although the latter may be true to type, colour, and general conformation. It is noticeable, too, that although the degree of fecundity in live stock is, to a very large extent, influenced by the feeding and conditions under which the animals are kept, this breed appears to maintain its prolificacy under almost every condition, although, as will be understood, there is a very much higher infant mortality where the stock are neglected than where they are given proper housing accommodation and attention.

It has been noted by those who have devoted time to careful research to these problems that the breeding powers of animals are most energetic when the animals are in moderate condition, uninfluenced either by extreme fatness or the reverse; hence, as the Large White breed is one that maintains itself in moderate condition and does not tend to run to fat, it is more fecund or prolific than those breeds inclined to fatness and of more blocky stature.

In the Farrowing Returns for 1932 published in the Herd Books of the National Pig Breeders' Association of Great Britain, it will be noted the feature of prolificacy is most pronounced, while the capacity to suckle and rear their families compares more than favourably with other breeds.

N.P.B.A. Farrowing Returns, 1932.

SUMMARY.

Breed.	Number of Litters Notified.	Average Pigs Born per Litter.	Average Pigs Reared per Litter.
Berkshire	382	8·46	6·87
Large White	5,713	10·32	7·86
Middle White	1,638	9·55	7·57
Tamworth	129	8·28	6·19
Wessex Saddleback	727	9·62	8·12

This shows that, of 5,713 litters notified, the average pigs born per litter, 10·32, was the highest of the five breeds of whom particulars are recorded by the N.P.B.A., and that the infant mortality was little or no higher in this than in any of the other breeds, the exception being the Wessex Saddleback, who, over several years, have recorded the highest percentage reared of pigs farrowed.

The breeder wants boars and sows that are prolific and ready breeders, whose litters are not only large, but in which each pig is a strong and quick grower. They must be of a firmly established type so that a litter shows uniformity in all points.

Plate 94.

Large White Boar, "Creek Bradbury 9th," a prominent prize winner at British Shows. Note light forequarter, long, lean body, and shapely conformation.

It is noticeable that big breeds of pigs are invariably more prolific than small breeds, although big breeds need more attention, and the returns they give are dependent almost entirely on the care given in

Plate 95.

Large White Sow, "Spalding Belle 41st," bred and exhibited by Mr. Alfred W. White, of the Spalding Herd, Spalding, England. A neat, attractive sow, showing light, neat forequarter, roomy body, and well-developed hindquarters.

feeding and management. A prolific sow is of great value to any farmer. Recently a pure-bred Large White sow in England bred and reared fifty-five pigs in five litters, and later farrowed her sixth litter of twenty-one live pigs. Another prominent Large White breeder there who keeps strict records, shows that in 1933, thirty-three farrowings produced 378 pigs, and an average of 11·45 per litter. Of this number 305 were weaned, an average of 9·24. Thus 80 per cent. of the pigs born were reared.

Plate 96.

Group of Large White pigs, who put up a good record in the Minnesota Record of Performance Test, U.S.A. Average daily gain in weight over period of test, 1.40 lb. Total foods per lb. live weight increase, 3.42 lb. Good growers of desirable conformation.

The Queensland record for a Large White appears to be held by Kingston Patricia 1346, a well-known prize-winning sow. She has had six litters—of 11, 15, 15, 15, 15, 15. She had her sixth litter before three years of age, and at that time was still in a productive profitable condition.

The Large White as a Baconer.

The suitability of any breed or cross for pork or bacon factory requirements is dependent almost as much on feeding and management as on breeding, although it is virtually impossible to make a bad pig a profitable one. The long lean side of the Large White is the feature that appeals to bacon curers; in addition, the fore quarter is light and fleshy while the ham is reasonably proportioned and can be improved upon by judicious crossing with breeds whose hams show more cushion and thickness. Desirable crosses include the Large White boar on Middle White or Berkshire sow, or on selected grade sows showing similar type.

For Queensland bacon markets, it is desirable that this system of crossing be followed, for if the Large White is crossed with the Tamworth, it is most difficult to finish the pigs for factory requirements within the weights required. For the export markets these more growthy, larger-framed pigs can be matured to advantage, but it is useless attempting to mature such pigs as porkers or lightweight baconers except at an expense in feeding that is not warranted.

Selection of Boar and Sow.

In the selection of boar or sow, special attention must be given to securing animals possessing a sturdy constitution, a quality denoted by a wide, deep, capacious chest, width between the eyes and ears, strong, straight forelegs wide apart and set well on the outside of the body. No tendency to inbent or weak knees should be allowed. The shoulders must be light, back long and straight with well-sprung ribs, roomy barrel and deep sides, hams thick and compact in comparison with size of animal, tail well set upon the rump. Both boar and sow should show twelve to fourteen or sixteen well-developed teats, with a deep level underline. Flanks must be deep and loose. The coat of hair must be thick, straight, and silky. A tendency to curly coat often indicates coarseness and, like short stubby hair, is undesirable. The head must be well developed, not too large and ungainly, but neat and attractive, the

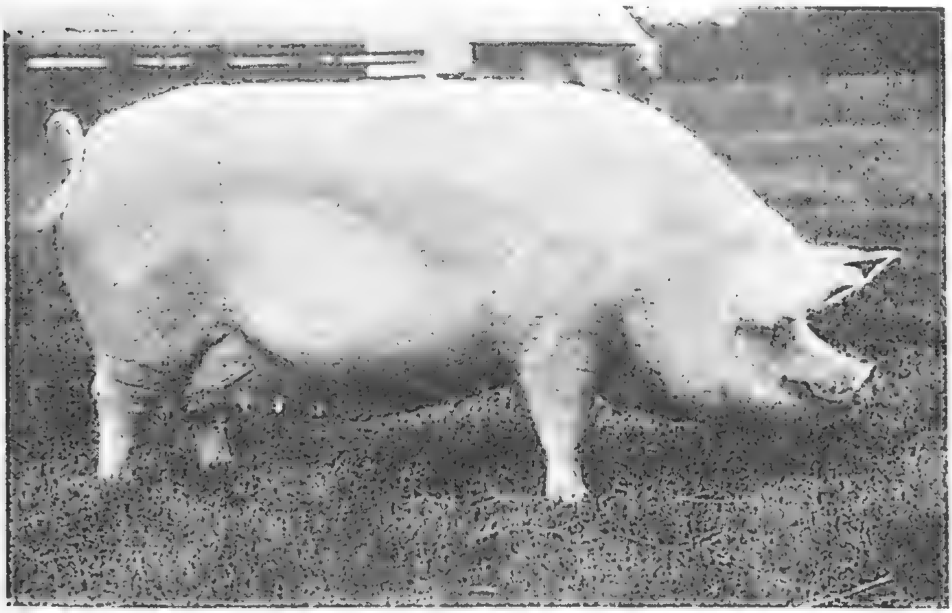


PLATE 97.—LOCKWITH BLACKBERRY, 8TH.
A championship prize-winning sow at British Shows. A matron of superior quality.

face slightly dished, the snout of medium length and somewhat pointed, the muzzle broad, eyes bright and kindly, the jowl light and running well into the neck. The ears should be of medium size and but slightly inclined forward and fringed with fine silky hair. The boar's breeding organs must be well developed—no sign of rupture or of abnormal swellings being allowed to pass without critical inspection. Never use a boar showing any weakness in this respect, as any weakness would probably be of an hereditary nature; look for quality both in flesh, skin, and hair, and rigorously cull any stock not coming up to the standard.

It is only families that are prepotent, prolific, vigorous, and contented that should find a place in the herd. Heavy shouldered, thick-set types are most objectionable in these long-bodied breeds, and invariably lack the powers of prolificacy and quick growth without which the Large White would soon prove unsuitable.

Litter Weight Performance.

Claimed as an Australian record for a Large White sow's production record the sow, "Vaucluse Jewel 5th," 840, has put up a record difficult to excel. Her pigs were produced and handled under official control, the figures being certified to by Victorian Government officials. The sow herself is a prominent prize winner, and is of a very prolific and productive type. She is registered and was bred in Victoria and a large number of stud stock have been selected from her litters, whose records are as follows:—

Litter Weights at Twenty-six Weeks of Age from Sow, "Vaucluse Jewel 5th."

1st litter, total weight at 26 weeks	2,400 lb.
2nd litter, total weight at 26 weeks	2,506 lb.
3rd litter, total weight at 26 weeks	2,375 lb.
4th litter, total weight at 26 weeks	3,187 lb.

or a total litter weight (reared to 26 weeks each litter) of 10,468 lb. within two years.

PLATE 98.—WALL BEAUTIFUL 11TH, 191626.

Supreme championship winner in Large White breed, Royal Agricultural Show, England, 1932. A wonderful sow in every way. Note her capacity to rear and suckle and her well-developed hindquarters.

Records such as these indicate what can be done by efficient feeding and control of a type of stock capable of quick and economical growth. It is well to remember, however, that such records cannot be expected in the absence of a sound knowledge of the business of pig-feeding and an understanding of the qualifications of the type of pig handled.

The Federal Council of the Australian Stud Pig Breeders' Society has adopted the following "Standard of Excellence" and Scale of Points for Large Whites:—

	Points.
Head and Ears.—Moderately long; face slightly dished, not too much turned up, wide between ears; jowl not heavy; ears long, thin, slightly inclined forward, and fringed with fine hair	15
Neck and Shoulders.—Long and full to shoulders, deep to chest; shoulders level across top, not wide, free from coarseness ..	10
Back and Sides.—Long, level, and wide from neck to rump; loin broad; ribs well sprung; sides deep, well let down to flank, with straight underline; and, in sows, twelve good evenly-placed teats	20
Hams.—Broad, full, and deep to hocks; tail set high, stout and long, but not coarse, with tassel of fine hair	20
Legs and Feet.—Straight and well set, level with outside of body, with flat bone; pasterns short and springy, with feet strong, even, and wide	15
Colour, Skin, and Hair.—Hair white, free from black hair, and as far as possible free from blue spots on skin; skin fine, free from wrinkles; hair long and moderately fine	10
Character.—A combination of all the points showing distinctive breeding, type, and quality	10
Total points allowed	100

CATTLE FEED RACK.

Here is a sketch of a cattle feeder which will hold a fair amount, and keep the animals in comfort during cold winter nights, without waste of fodder. Figure 1 is designed of sawn timber. The frame is 6 feet wide, 6 feet high, and 8 feet long, built on runners to be easily moved about the yard. The pickets are 6 feet long, so that they project 18 inches to 20 inches above the top of the frame. The picket frame is open at the bottom about 18 inches, to let the hay down on to the A-shaped elevated divider in the centre of the floor, which helps to distribute it within reach of the calves. The tight floor is boarded round with a rim of 4 by 2 to prevent waste of the finer particles of grass, hay, or lucerne hay. It may be boarded up higher to

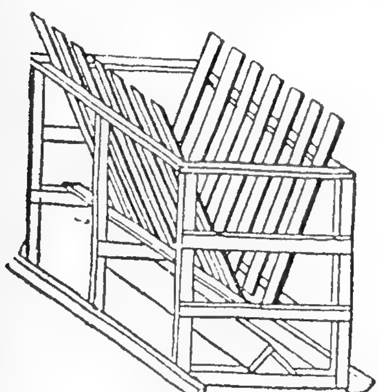


Fig. 1.

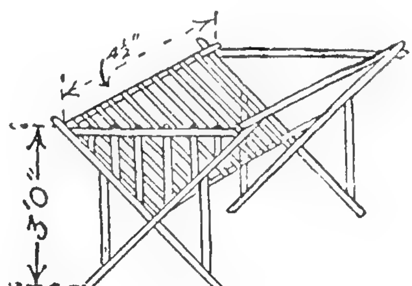


Fig. 2

PLATE 99.

make of the lower floor a feeding trough for grain or silage. Should a cover be thought necessary, the end post may be made higher to carry the roof, the hay being then filled in through the gable ends. If the present top bar on the end posts were made to swing it would facilitate filling the rack. Figure 2 shows a feed rack of a bush type for feeding lucerne, &c., to sheep. It is 6 feet long, 3 feet high to the top bar, and the slats are 4½ inches apart. In the sketch, for the sake of clearness, the open sparwork is shown only on one side and one end. Some dairy farmers do not like the overhead racks, and might prefer the bush rack even for cows.

The Problem of Youth.

ST. LUCIA FARM SCHOOL.

By J. F. F. REID.

NO nation can afford to allow a generation to grow up in idleness. So priceless a heritage is the right to work for an independent living and for personal liberty that it is worth every sacrifice we can make for the full-time employment of the mind and muscle of our youth—Australia's manhood of to-morrow.

PLATE 100.—A POPULAR RENDEZVOUS.
The Dining Hall muster for the midday meal. The St. Lucia menu is, probably, unexcelled at any other boarding school in Queensland.

A realisation of those facts was the force behind the establishment of the St. Lucia Farm School, and is still the impelling force behind further efforts of the Departments of Agriculture and Stock, of Labour and Industry, and of Public Instruction. Co-operating with the Government in its search for a solution, in part at least, of the biggest problem confronting the nation—the problem of unemployed youth—are the Churches, the New Settlers' League, the Legacy Club, the Rotary Club, and other social organisations.

The Story of St. Lucia.

Two years ago a conference of representatives of the Departments and social organisations named was convened by Mr. Frank W. Bulcock, Minister for Agriculture and Stock. At that conference Mr. Bulcock outlined a project for the establishment of a farm training school at a place convenient to the city, at which boys with no immediate prospect of absorption in industry, and without previous rural experience, might be trained for a life on the land. Addressing the conference, the Minister said, *inter alia,* that there were many reasons why a State must engage in an active "young man's land movement" under proper conditions.

PLATE 101.—GROUP OF TRAINEES, ST. LUCIA FARM SCHOOL.

Seated in the centre of the front row (left to right) are Messrs. A. J. Bowman (Farm Foreman) and F. Skinner (Queensland Agricultural College). The Supervisor, Mr. J. A. Kerr, was absent at Moggill with a large party of boys who are undergoing a course in practical bushcraft, when the photograph was taken.

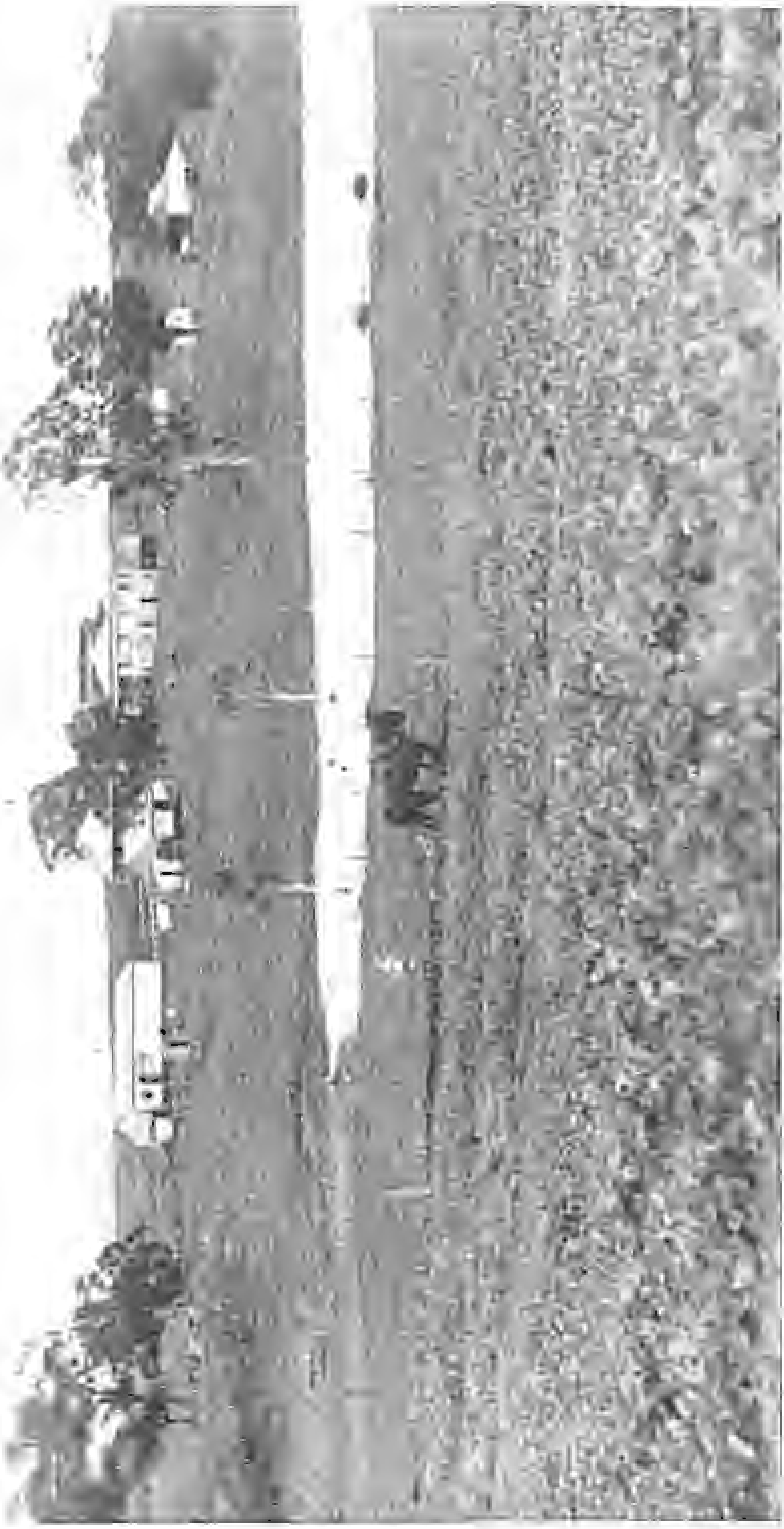


Plate 102.—A General View of the St. Lucia Farm School Buildings.
From left to right—The Dining Hall, Cook's Cottage, Office, Store, Staff and Trainees' Quarters (centre), Poultry House, Dry and Milking Sheds.

Plate 103.—Points of a Good "Poddy."
A Dairy Instructor demonstrating at St. Lucia Farm School.

Plate 104.—A Riverside Rural Scene at St. Lucia.
Fodder cultivation and conservation is practised as well as preached at the Farm School.

First, if they agreed that the limits of production had been reached, then there was no hope in the future for Queensland, in common with Australia generally. They could not escape their agricultural destiny, and therefore must wisely direct it. Wise direction must be the very opposite to the policy of despair that was associated with restriction of land settlement. Rather must they continue to produce with skill and distribute with wisdom. Queensland was a primary producing State, and while they were labouring under a cloud of depression it was natural to expect that their primary industries would suffer, but economic surveys had shown that periods of depression alternated with periods of prosperity. One of the great difficulties confronting the statesmen and economists of the world was the regulation of phases of economic interplay and the evolution of a system whereby a general satisfactory

PLATE 105.—GRAZING DOWN THE STUBBLE.

On St. Lucia is a fine herd of thirty dairy cows, grade Jerseys, mainly. Sound dairy management is practised at the Farm School, and this picture shows the cows grazing contentedly on the stubble of an oat crop recently harvested.

average should be obtained. That surely was not beyond the ability of mankind, and agricultural history of recent years had shown distinct evidence of stabilisation. Australia could never agree to a policy of general limitation of production, and he believed that that phase, which was associated so closely with present circumstances, would pass away with the passage of the conditions that had given rise to the advocacy of restriction. The time, therefore, had arrived to prepare for the farming future of the State, and the material to employ was the youth, both of the country and the city.

A survey of immediate prospects could not encourage parents to hope for the speedy employment of their sons in industrial occupations. Queensland had the lands and had the adaptable youth, but the difficulty of bringing both together was difficult of adjustment. He believed it rested particularly in an appreciation on the part of the parents of the merits of an agricultural career for their sons, the promotion of a land

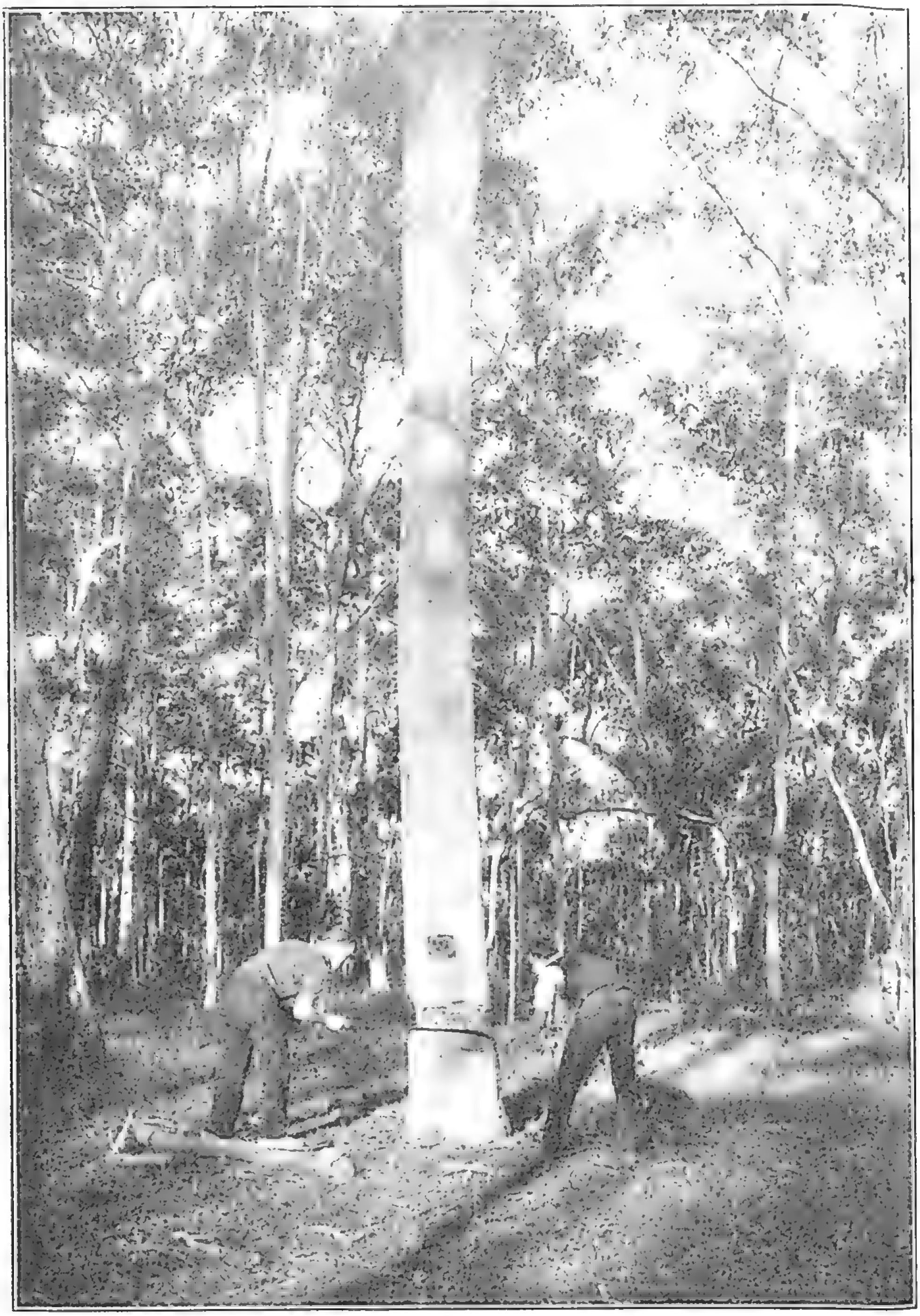


PLATE 106.—SAWING THE BACK CUT.

St. Lucia Trainees are taught various branches of bushcraft in the Queensland University forest lands at Moggill.

Plate 107.—Stand Clear for the Crash!
The falling tree was belly-scarfed and sawn by St. Lucia Farm Trainees in 7¼ minutes.

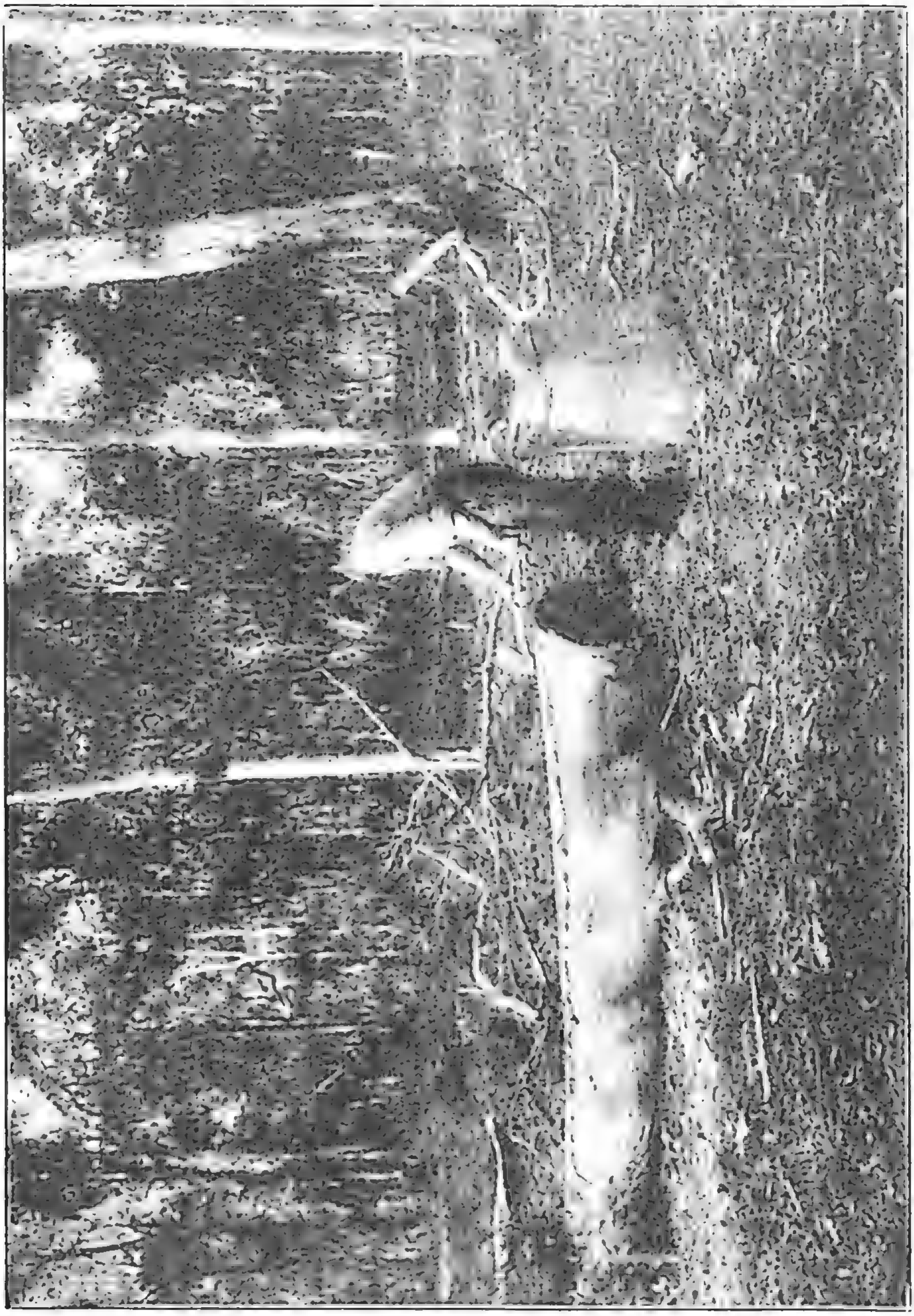


PLATE 108.—BARKING THE FALLEN LOG.
Preparatory to sawing it into fence-post lengths.

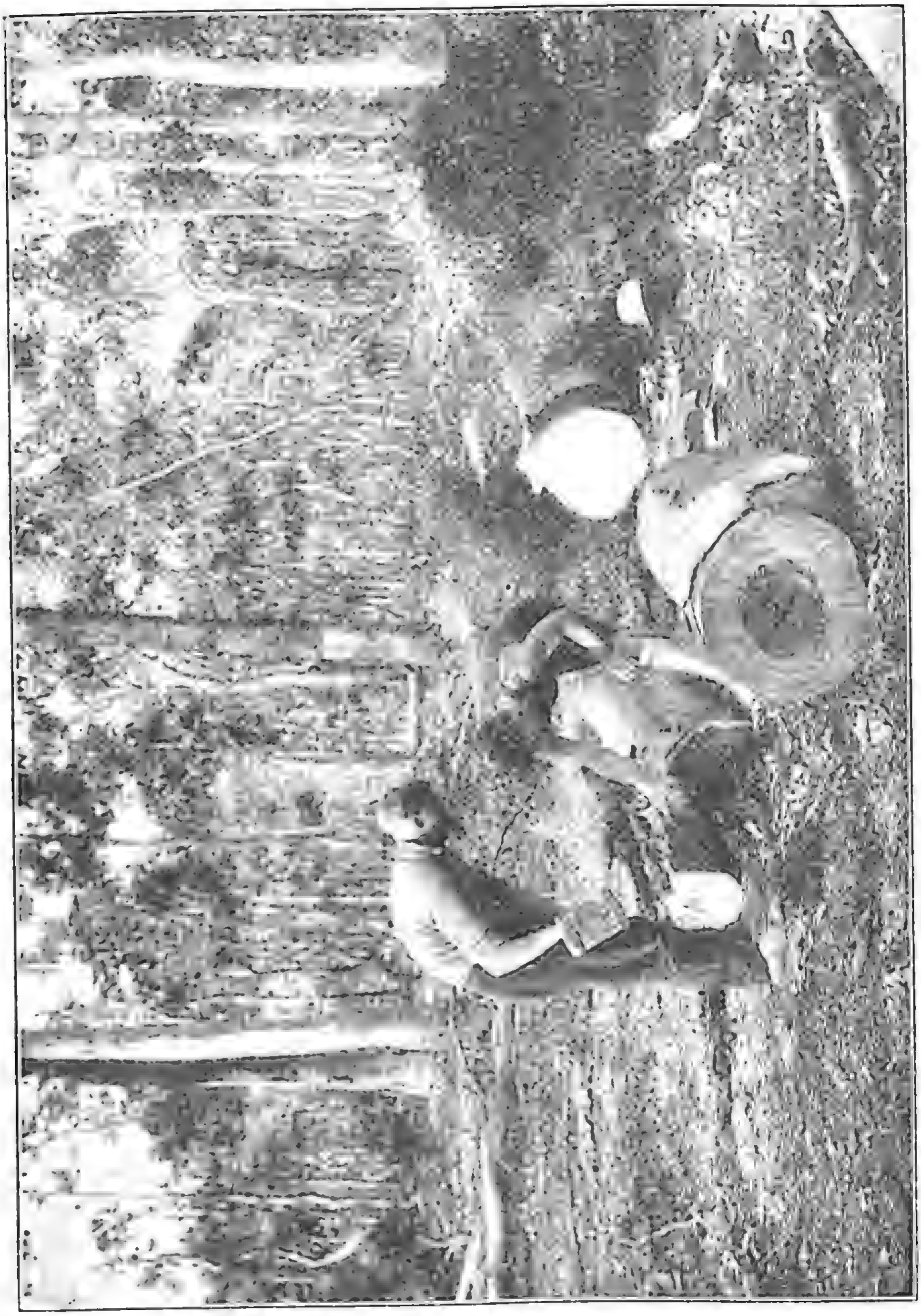


Plate 109.—Entering a Wedge.
St. Lucia Trainees engaged in splitting fencing timber.

consciousness in the city youth, and a recognition of the channels through which a boy should pass in order to become a farmer.

Mr. Bulcock then sketched the project he had in mind for the establishment of a farm training school at which, under pioneer conditions, boys who were unable to obtain regular employment, and who were likely to develop landmindedness, might undergo a rudimentary course in agriculture and so qualify for employment in rural pursuits.

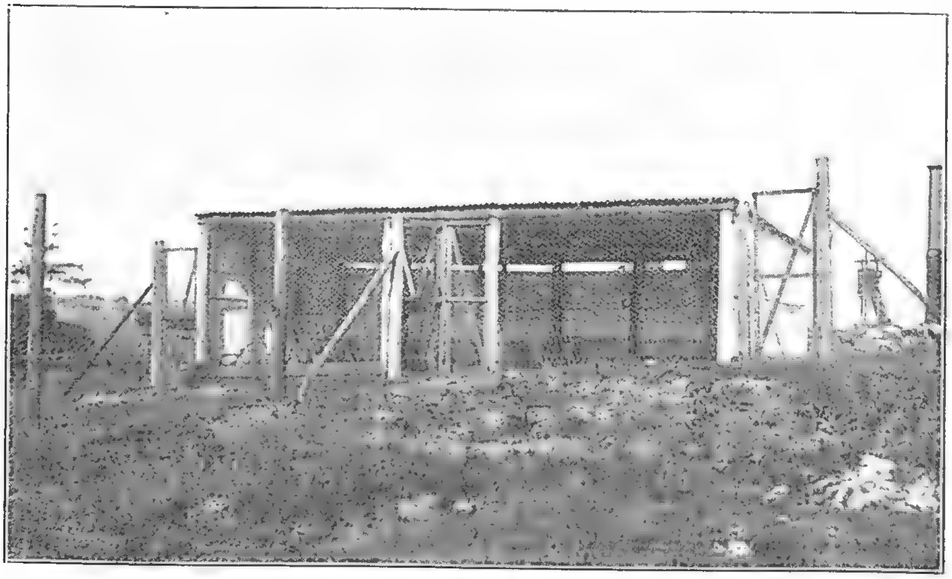


Plate 110.—Poultry House and Pens at St. Lucia.
All buildings and dividing fences were erected with material from the Moggill forest by Trainees as part of their general course of instruction.

The conference commended the project unanimously, and appointed a number of committees to advance it to a concrete stage. The Queensland University offered the use of its lands at St. Lucia and Moggill, which it acquired some years before as a University site through the generous and public spirited gift of Dr. and Miss Mayne. Fifty or sixty years ago this land was under sugar-cane and other crops, and a considerable portion of it consists of fertile river flats, and it is otherwise well adapted for the purpose of a farm training school. As the University is not likely to occupy the area for some years to come, it is the general belief that it could not be put to better immediate use than that of a training ground for potential primary producers.

The four committees appointed—organising, curriculum, admissions, and employment—set to work at once on the details of the scheme, and by the following January the training farm became an accomplished fact. It is significant that it has not been necessary to call the employment committee together since the launching of the scheme, for the demand for youths trained at St. Lucia is far greater than the supply.

A Farm Within A City.

A ten-minute motor run takes one from the heart of the city to the pleasant rural scenes of St. Lucia, situated within a hair-pin bend of the beautiful Brisbane River. There are several ways of approach, and the

most direct is by tram to West End, thence by ferry across the river. The nearest way by road is through the riverside suburb of Toowong, but the most interesting route runs through Taringa along Swann road and the crest of a forested ridge from which magnificent vistas stretch away beyond the Peak Mountains, near Ipswich, to the great mountain masses of the Macpherson Range, discernible in the mist-filmed distance and bordering New South Wales. Northward the outlook takes in the whole of the city proper with its lofty Town Hall tower dominating the lesser spires and domes. Westward, forest-clad spurs rise to the bold escarpment of Mount Cootha and the wooded crests of its parent range. Below is the wide sweep of a pretty reach of the river curving in conformity with its serpentine course. On the further bank and back of it is picturesque Yeronga rising to the hills of Tarragindi, and Dutton Park clinging to the steep slopes that ascend to Dornoch Terrace. The sun-silvered surface of upper river reaches glistens amid fields of emerald enamel, specked with the ruby roofs of bungalowed suburbia. A turn of the road and St. Lucia Farm comes within this view of a city beautiful and its glorious environment.

From the entrance gate a long lane leads to a cluster of farm buildings. Away to the right a football field claims a stretch of level land, and nearer at hand is a well-constructed tennis court. A well-conditioned dairy herd is grazing contentedly on the stubble of an oat crop. Curving round the river bend are fields of lucerne and other fodder crops, contrasting in their intense greenness with the native pasture, frosted yellow. Out on the farm boys are busily ploughing, harrowing, and fencing; from the vegetable garden on the further side of the lagoon the earth-polished blade of a hoe flashes intermittently in the sun.

A Training Farm Established.

St. Lucia Farm School was founded by Mr. Frank W. Bulcock, Minister for Agriculture and Stock, and opened by him on 31st January, 1933. Fifty youths, ranging in age from seventeen to twenty years, all from the Brisbane city area, were enrolled. That enrolment, with occasional additional increases, has remained practically constant ever since. In accordance with the original plan, half the boys were admitted as boarders and half as day trainees. Mr. F. O. Bosworth, B.A., of the staff of the Queensland Agricultural College and High School, from which he was seconded for a term, was the first Officer in Charge. On the completion of his term Mr. Bosworth returned to the College, and Mr. J. A. Kerr, a graduate of that institution, was appointed Supervisor of the Farm School.

The curriculum of the Farm School is planned on broad lines, with the idea of giving the boys a thorough grounding in the rudiments of ordinary farm routine. Instruction is given in all branches of dairy practice, pig raising, poultry keeping, and general farm field work.

The farm contains about 170 acres, consisting of undulating country and fertile river flats. The soil on its arable area is mostly sandy loam with some heavy alluvial patches. It is well adapted for dairying and mixed farming. At present 32 acres are under cultivation, of which 5 acres have been designed as pasture improvement plots for both instructional and experimental purposes. Fodder crops are grown and conserved. English potatoes, sweet potatoes, pumpkins, and arrowroot

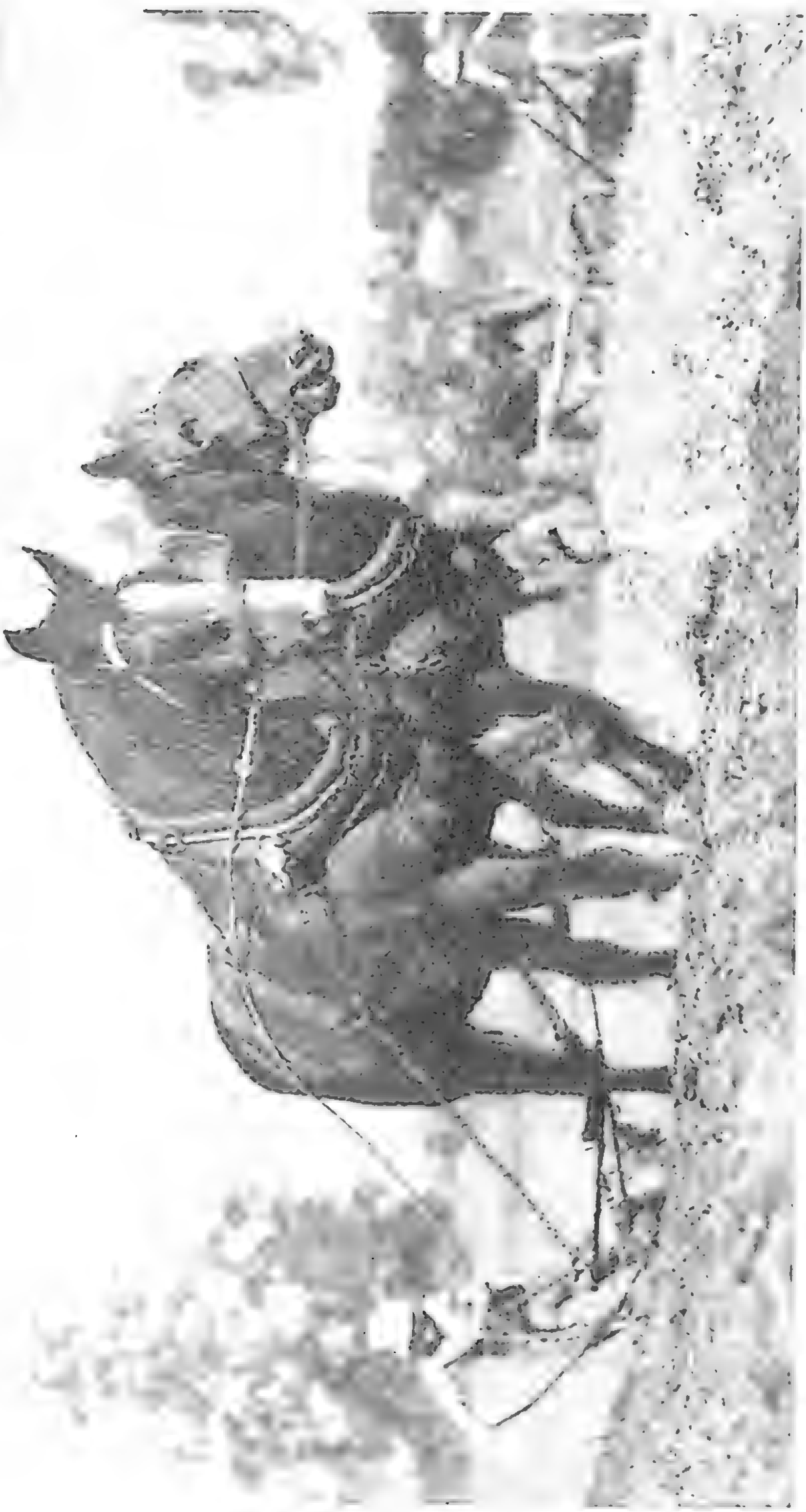


PLATE 111.—HIS FIRST LESSON.

There is knack in holding the plough handles, with the risk of a knock on the solar plexus, as the farm learner soon finds out.

[*Photo. by courtesy of the "Telegraph," Brisbane.*

PLATE 112.—A TOUGH TASK.

Cane ploughing new land matted densely with paspalum. The picturesque suburb of Yeronga is on the further river bank.

PLATE 113.—OPENING A FRESH FURROW.

The heights in the distance are on the other side of the river at Dutton Park. Wild ducks and other aquatic bird life find sanctuary in the lagoon at St. Lucia.

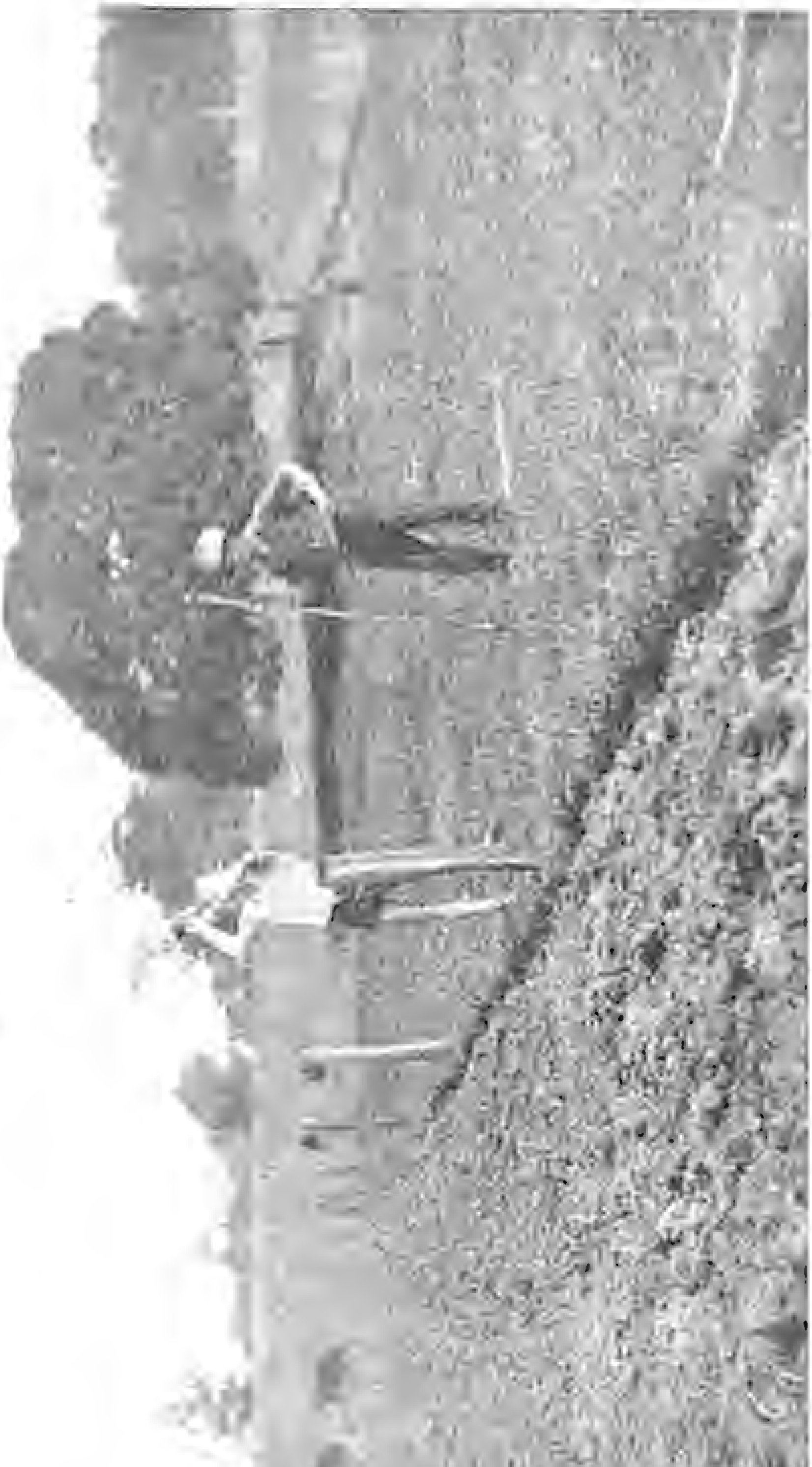


Plate 114.—Wielding the Maul.
A temporary stake fence to enclose a fine sward of Italian rye grass (right) on St. Lucia, in course of erection.

are also grown, the lastmentioned being used as pig feed. Irrigation—a spray system—is practised in an extensive and well-cropped vegetable garden. An extensive plantation of Queensland nuts has been established, and within a few years these beautiful and profitable native trees should form a striking feature of the St. Lucia landscape. The farm is practically self-supporting, and in the general dining hall at St. Lucia meals probably unequalled in quality and quantity at any other boarding school are served.

The boys find healthy and interesting recreation on the football ground, tennis courts, and in a reading-room in which a radio set has been installed. Daily and weekly papers are supplied through the courtesy of the management of each of the three Brisbane dailies.

Besides the farm at St. Lucia, there is a tent camp in forest country at Moggill, also University land, to where working parties are taken from time to time for instruction in bush craft and pioneering, including the use of the axe, crosscut saw, and maul and wedges. From this camp is supplied all the fence posts and round building timber required at St. Lucia. Groups of boys are also taken, from time to time, to Beerburrum, where they receive tuition in tobacco cultivation and the curing and grading of tobacco leaf. Accompanied by an instructor, the boys also visit, on occasion, the Roma Street Markets, the Kingston Butter Factory, and a commercial pig farm in its neighbourhood. Field officers of the Department of Agriculture and Stock visit the farm, as required, to lecture on dairying, pig raising, poultry keeping, agriculture, fruit and vegetable growing, chemistry of the soil, botany, entomology, and plant pathology.

Piggeries, portable and permanent, have been built by the trainees on the farm in conformity with the general instructional programme. Brood sows of the Large White, Tamworth, and Berkshire breeds are housed, and litters of pedigreed and crossbred pigs are raised for the purpose of instruction in piggery management.

A fine dairy herd, grade Jerseys, running on the St. Lucia pastures supplies milk and butter to the establishment. Both disc and mouldboard ploughs are used in the cultivation of a large acreage. Standing crops of winter cereals, mangels, maize, lucerne, vegetables, and fine swards of introduced grasses are evidence of the industry of the trainees and the practical nature of the instruction they receive.

At the end of July last year the first group of trainees completed their course in the rudiments of rural industry, and were quickly absorbed in farm employment. Since then the demand for boys trained at St. Lucia has far exceeded the supply. It has been so arranged that every quarter half the personnel of the establishment is available for engagement in country jobs, and the boys are placed immediately. As each group leaves a similar number is enrolled to keep the establishment up to full strength.

Scholarships Awarded.

At the end of every quarter an examination is conducted by officers of the Department of Agriculture and Stock for the purpose of selecting a lad for a free scholarship at the Queensland Agricultural College and High School at Gatton. Five scholarships have already been awarded. The reports of the examiners invariably contain comments on the high standard attained by the candidates. This is not surprising,

Plate 115.—Sighting a Line of Fencing.
Example of practical instruction at St. Lucia Farm School.

Plate 116.—The End of the Swing.
Driving stakes in a temporary fence to enclose a pasture plot.

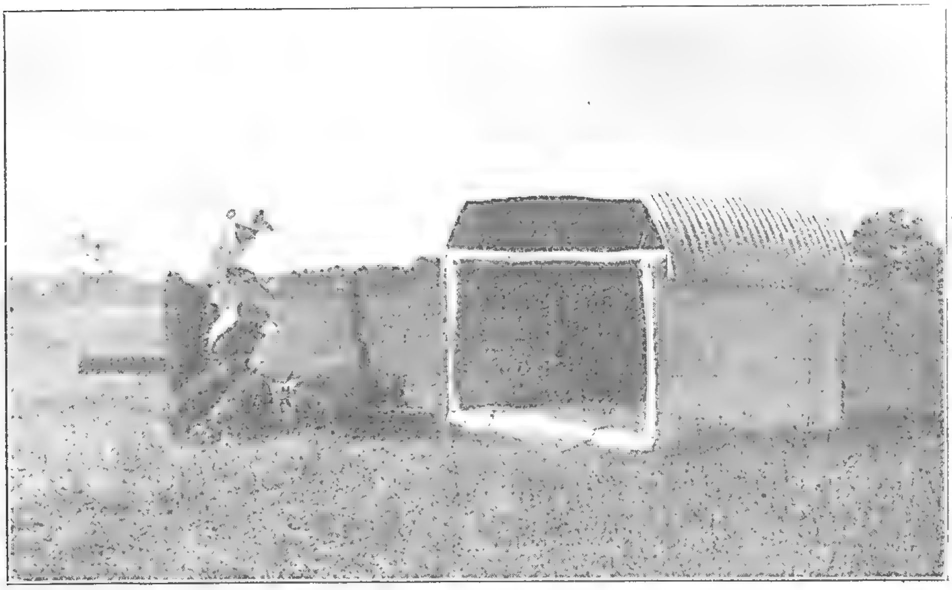


PLATE 117.—FEEDING THE MORNING MILK TO A HUNGRY LITTER.
Piggery management is part of the curriculum at St. Lucia Farm School. The portable shelter was constructed by the boys from scrapped material found on the farm.

PLATE 118.—PREPARING LAND FOR LUCERNE.
Plough teams in charge of Trainees at St. Lucia.

Plate 119.—Youth at the Plough.
Learning to open a straight furrow at St. Lucia Farm School.

Plate 120.—Giving the Horses a "Blow."
A scene on St. Lucia. The lad was receiving his first lesson in ploughing and the handling of a team. Mount Coot-tha and D'Aguilar Range in the distance.

PLATE 121.—BREAKING DOWN THE CLODS.
Every branch of farm field work is included in the school programme.

PLATE 122.—PREPARING LAND FOR ANOTHER CROP.

Plate 123.—Picking Peas for the Pantry.

St. Lucia Farm School is practically self-supporting in respect of food supplies.

Plate 124.—At the End of a Well-cropped Cabbage Row.

for many of the trainees have passed the State Scholarship Examination and have been educated up to the Junior University grade. The successful candidate is awarded a twelve-months' scholarship at the College at Gatton, and is given the opportunity of gaining an extension of the scholarship for a further term. For the boy who realises, as some of them obviously do, that "The Chance of a Lifetime is only during the Lifetime of the Chance," the extension scholarship may lead on to the Agricultural Faculty of the Queensland University. Thus the gate of opportunity is wide open to the boy who passes through St. Lucia.

Conditions of Enrolment.

Parents who desire that their boys should enter the school should place themselves in touch with the Interviewing Officer (Mr. J. Kilmartin), Department of Agriculture and Stock, William street, Brisbane. Trainees are accepted at any age between fourteen and twenty-one years. The boys pay no fees, and receive free board. Farmers who desire to engage the services of the youths at the end of their training term should communicate with the Lads' Employment Bureau, Box 1448 T., General Post Office, Brisbane. The boys represent a fine type of Australian youth—keenly intelligent, country-conscious, active, energetic, and imbued with an excellent spirit. Their general standard of conduct is high, and the staff has succeeded in establishing a good tone in the farm school, to which the character and calibre of the young trainees responds very readily. Reports from farmers who have St. Lucia trainees in their employ are, invariably, highly appreciative.

The foregoing, briefly, is the story of St. Lucia, which, it is believed, is measuring up to the ideal of its founder and fulfilling the hopes of the interested citizens who support him in what is regarded as an important social movement designed to counter the effects of the existing economic situation—to some extent, at least—by directing the youth-power of the land into fields of primary production. The main idea behind the scheme, the success of which was never doubted and which has already been amply proved, was to give workless city boys an opportunity of training for a country career.

The problem of youth is to find fitting opportunities for youth on the threshold of youth's career. We have suffered the years of economic depression in common with every other country, but the inherited spirit of Australians is such that it would take many more years of deferred hope to damp the ardour of Young Australia. These boys of ours are game and willing. They are ready; they are prepared. Therefore, Queensland must give them their opportunity. There is plenty of room in Australia, there are "potentialities" to absorb the energy of millions. To find in this field the chance for our own young people is the present and most pressing duty of the nation. The farm school at St. Lucia—to which may soon be added similar institutions in other parts of the State—is, at least, some evidence of our acceptance of that duty.

Agricultural Notes.

H. W. BALL, Assistant Experimentalist.

MILD winter conditions continue up to the time of writing throughout the coastal agricultural areas, and following on the good season experienced the usual decline in pastures and consequential dairy production has not been unduly pronounced. Acting in accordance with Departmental advice, an increasing number of farmers are supplementing their reserves of fodder by early and successive sowings of winter crops, such as barley, oats, and wheat, thereby maintaining production and keeping stock in good condition throughout the period of natural scarcity of feed. The sowing of lucerne and winter grasses is also receiving greater attention, and experience thereby being accumulated of those species which are likely to give the best results in the various districts.

PLATE 125.

A FIELD OF "NOVO" WHEAT AT WILLOWVALE, DARLING DOWNS.

"Realisin' he was wealthy in what makes a life worth while."

Wheat.—The outlook for the present season is uncertain, as, owing to dry autumn conditions throughout the chief producing areas, early cultivation was retarded, and this fact, in conjunction with the low price levels prevailing, is likely to result in a reduced acreage being sown. The Dalby district experienced more favourable conditions, many hundreds of acres of new land being sown, and crops in this area are generally in good heart. In the Clifton district it was necessary to feed off the rank growth of early-sown crops after the July rains, whereas in the Warwick district and the Maranoa considerable areas have had to be replanted. From the above remarks it will be noted that the season, to date, has been rather patchy.

Sugar.—With mid-winter conditions prevailing in all cane areas, very little crop growth was recorded for the month of July. No serious frosts have been reported, however, and it is now certain that little damage will be inflicted from this cause, as practically all mills are operating. Fortunately, the absence of heavy rains in the far North has enabled the farmer to push ahead with his land preparation for next year's crop; planting has been unduly delayed in these parts.

The milling returns to date show that the sugar content of the crop is high, in contrast to the low values recorded last year. It is as yet too early to revise the preliminary crop estimates, as much will depend on the growing conditions experienced in the early spring months.

The cane planted prior to the winter has given, in general, satisfactory germinations and the early-planted crop is finding conditions favourable for its development.

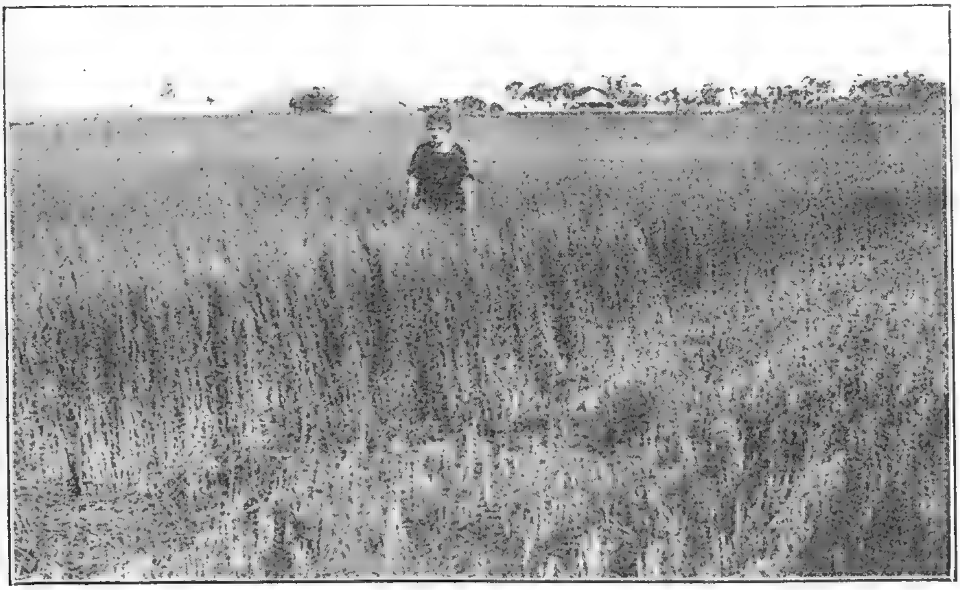


PLATE 126.

"THREE SEAS" WHEAT AT FREESTONE, DARLING DOWNS.

"When the settin' sun is gettin' low above the western hills,
When the creepin' shadows deepen, and a peace the whole world fills."

Cotton.—The harvesting of the cotton crop has continued at a good rate during the month, heavy receivals having been experienced at both ginneries. The total amount of seed cotton sent in by the end of July will approximate 23,000,000 lb., which is nearly 28 per cent. greater than the previous record crop for the State. Considerable cotton still remains to be harvested, and it appears likely that the total for the season will be in the neighbourhood of 25,000,000 lb. of seed cotton, which will be obtained from, roughly, 50,000 acres grown by 3,100 growers. The average yield will be a decided improvement over those of the previous three seasons, when such disastrous drought conditions prevailed. Had the entire months of January and March not been dry a much higher average yield per acre would have been

obtained, for, at the end of December, the possibilities were most promising of obtaining exceptionally high yields in most of the districts.

The dry weather following the frosts in mid-June has hastened the opening of the top crop, which will thus allow of the cutting off and burning of the plants in time to start the preparation of the new seed beds in good season. The results obtained in this crop, however, would indicate that it is advisable to plant at least a portion of the cotton area on either newly-brought-in cultivation out of grass land, or following some fodder crop, for apparently a greater factor of safety exists against seasonal variations where cotton is grown on such soils as compared to where cotton has been grown for several seasons in succession.

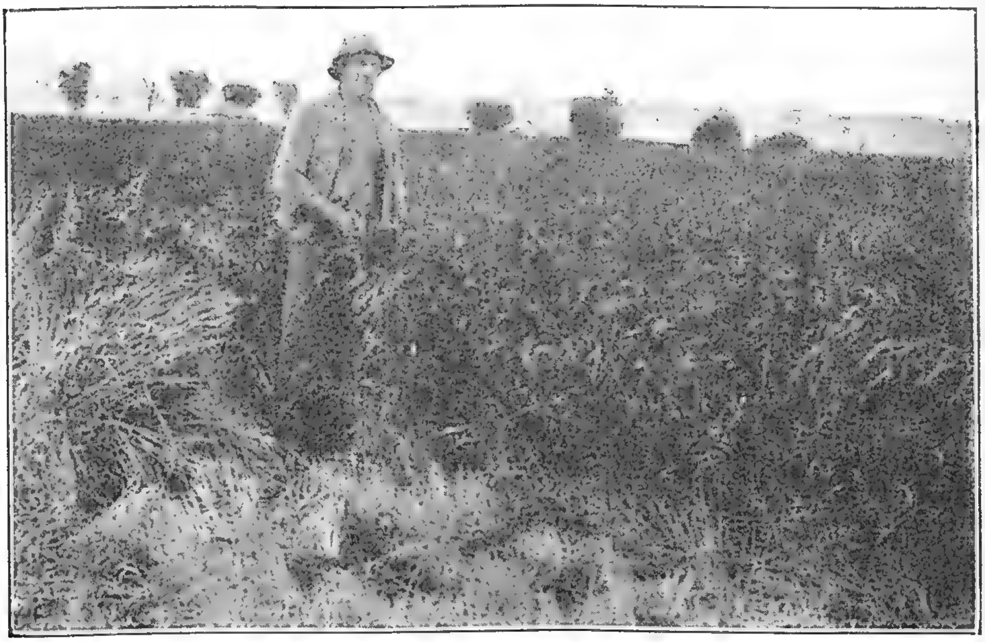


Plate 127.

"Waratah" Wheat at Yangan, Darling Downs.

"Wheat, Wheat, Wheat! When it comes my turn to meet
Death the Reaper, an' the Keeper of the Judgment Book I greet,
Then I'll face 'em sort o' calmer with the solace of the farmer
That he's fed a million brothers with his Wheat, Wheat, Wheat."

The Director of Cotton Culture advises that planting seed is now being distributed from the Whinstanes and Glenmore ginneries. Before applying for their seed, it is recommended that growers ascertain from the Cotton Section of the Department of Agriculture and Stock, Brisbane, particulars as to the suitability of their soils for growing some of the high lint per cent. medium staple cottons that are being distributed this season. Any inquiries should be accompanied by a full description of the soils on which it is intended to grow cotton, stating whether originally covered with scrub or forest, slopes or alluvials, clay, clay loams or sandy loams, number of years under cultivation, and the name of any variety of cotton that has given good results on the plot or on similar soils in the district.

Maize.—Harvesting of this crop has now been completed. Late-sown maize is very accommodating in this respect, as, given normal weather, it will stand over well into the winter. Although not a record, the returns are over the average, the crop being estimated at 4,500,000 bushels. In the Atherton district a reduced acreage was sown, and the yields also reduced by the excessively wet conditions. The low values being obtained for maize and other grain crops provide an excellent opportunity for stockowners outside the farming areas to purchase stocks which can be stored against the inevitable periods of drought.

Tobacco.—Curing is nearing completion, and grading is being carried out both on farms and grading sheds. Some good-quality leaf has resulted and sales made at satisfactory prices, a choice parcel of northern leaf bringing 4s. per lb. at a recent sale. Although the present season's production has fallen considerably below that of 1933, chiefly owing to the heavy rainfall, growers generally are optimistic, and the experience gained will be of value; so a gradual expansion of the industry on sound lines may be confidently anticipated. In the Mareeba and adjacent districts, peanuts are likely to become a good subsidiary crop for tobacco-growers, as yields of up to a ton per acre of good-quality nuts have been obtained where suitable fertilizers have been used.

Markets.—Fair values have been maintained for primary produce, although lucerne hay, chaff, and protatoes have been in heavy supply. Good-quality potatoes have brought over £11 per ton. At this season a large quantity arrive from the Southern States, particularly for seed purposes, and owing to the condemning of some consignments an exchange of Inspectors under the Diseases in Plants Act with Southern Departments of Agriculture has been suggested, so that an increased knowledge of the market requirements and also greater immunity from introduced disease may be obtained.

All stock are reported to be in good condition and sound values maintained.

Draught horses are in demand and have brought exceptionally high prices at various Downs centres, over £30 being paid for good animals.

A FORMULA FOR WHITEWASH.

Obtain, if possible, large pieces of fresh lump lime, place them in a very large bucket or other suitable container, and into this pour hot water. Cold water will do, but hot water is better, as it hastens the slaking. The lime will start to boil and break up. Keep it covered all the time with about half an inch of water. This is important, for if whilst the lime is slaking it is allowed to rise up above the water in a dry powder it will "curdle," a condition tolerated only by inexperienced and indifferent workmen. Before the lime commences to boil fiercely add tallow or common fat in the proportion of about 7 lb. to 14 lb. of lump lime. This makes a good binder which will prevent the wash from rubbing off. If desired, a little yellow ochre may also be added, which will give a cream or buff tint according to the quantity used. When the lime is thoroughly slaked it should be stirred and sufficient water added to make it a little heavier than, say, milk, after which it should be strained and, if desired, may be applied whilst hot.

AGRICULTURE ON THE AIR.

Radio Lectures on Rural Subjects.

Arrangements have been completed with the Australian Broadcasting Commission for the regular delivery of further radio lectures from Station 4QG, Brisbane, by officers of the Department of Agriculture and Stock.

On Tuesdays and Thursdays of each week, as from the 3rd July, 1934, a fifteen minutes' talk, commencing at 7.15 p.m., will be given on subjects of especial interest to farmers.

Following is the list of lectures for July, August, and September, 1934:—

SCHEDULE OF LECTURES.

BY OFFICERS OF THE DEPARTMENT OF AGRICULTURE AND STOCK, RADIO STATION 4QG, BRISBANE (AUSTRALIAN BROADCASTING COMMISSION).

Tuesday, 7th August, 1934—"The Packing and Preparation of Tomatoes for Market." By J. H. Gregory, Packing Instructor.

Thursday, 9th August, 1934—"The Avocado in Queensland and Elsewhere." By H. Barnes, Director of Fruit Culture.

Tuesday, 14th August, 1934—"Packing Shed Hygiene." By J. H. Gregory, Packing Instructor.

Thursday, 16th August, 1934—"The Importance of Citrus Bud Selection." By H. Barnes, Director of Fruit Culture.

Tuesday, 21st August, 1934—"Papaw Cultivation." By H. Barnes, Director of Fruit Culture.

Thursday, 23rd August, 1934—"The Pasteurisation of Milk and its Products." By O. St. J. Kent, B.Sc., Analyst.

Tuesday, 28th August, 1934—"Vitamins in Dairy Products." By O. St. J. Kent, B.Sc., Analyst.

Thursday, 30th August, 1934—"Factors Influencing the Amount of Fat in Milk." By O. St. J. Kent, B.Sc., Analyst.

Tuesday, 4th September, 1934—"Seasonal Farm Crops," Part I. By C. J. McKeon, Instructor in Agriculture.

Thursday, 6th September, 1934—"Seasonal Farm Crops," Part II. By C. J. McKeon, Instructor in Agriculture.

Tuesday, 11th September, 1934—"Seasonal Farm Crops," Part III. By C. J. McKeon, Instructor in Agriculture.

Thursday, 13th September, 1934—"The Tobacco Industry Protection Act of 1933." By H. S. Hunter.

Tuesday, 18th September, 1934—"Some Requirements of Plant Growth." By E. H. Gurney, Agricultural Chemist.

Thursday, 20th September, 1934—"Fertilizers and Manures." By E. H. Gurney, Agricultural Chemist.

Tuesday, 25th September, 1934—"Nutritive Value of Pasture." By E. H. Gurney, Agricultural Chemist.

Thursday, 27th September, 1934—"Mineral Ingredients in Stock Foods." By E. H. Gurney, Agricultural Chemist.

CARE OF THE WORKING HORSE.

Most derangements of the digestive organs of horses are due to errors in diet, and a good and regular system of feeding will do more than anything else to prevent trouble of this kind. The following rules for feeding are generally accepted as correct:—

Water before feeding, and not for at least an hour after.

Feed in small quantities, and often.

Do not work hard immediately after a full feed.

Never give a horse food to which it is not accustomed in large quantities.

If these rules are followed, and care taken to ensure that only sound, good food is fed, very little trouble will be experienced.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Ayrshire Cattle Society, production charts for which were compiled for the month of June, 1934 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORN.			
	MATURE COW (OVER 5 YEARS OLD), STANDARD 350 LB.			
Scarlet XII of Springdale	V. Dunstan, Wolvi	12,208·15	583·757	Don of Springdale
Springleigh Primrose	Moller Bros., Boonah	12,924·95	567·101	Kelston Warrior
Queenie 3rd of Glengarry	G. Waugh, Peeramon	12,469·8	477·794	Jambaroo Glengarry
Model XX of Springdale	V. Dunstan, Wolvi	11,356·35	407·877	Lovely's Commodore of Burradale
	JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.			
Happy Valley Bangle 2nd	R. R. Radel, Coalstoun La es	7,628·15	330·016	Molly's Hero of Glenthorn
	JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.			
Stella 2nd of Blacklands	A. Pickels, Wondai	9,824·15	362·410	Hugo of Blacklands
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Rosenthal Dove 15th	S. Mitchell, Rosenthal	5,651·5	253·116	Rosenthal Reward
Kingsdale Tot 5th	A. A. King, Mooloolah	7,711·1	315·408	Express of Burradale
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
Mabreen Ivy	V. Dunstan, Wolvi	7,985·45	334·988	Vumbawarra Headlight
Westbrook Bell	W. F. Kajewski, Glencoe	7,592·79	280·162	Sunrise 3rd of Rosenthal
Glenroy Rita	W. F. Kajewski, Glencoe	6,818·23	271·844	Glenroy Kitchener
Westbrook Jinny	F. G. Couper, Westbrook	6,017·96	238·304	Westbrook Ronald
	JERSEY.			
	MATURE COW (OVER 5 YEARS OLD), STANDARD 350 LB.			
Kelvinside Ideal's Noble Idol (365 days)	J. and R. Williams, Crawford	10,165·65	619·83	Noble of Yaralla

	SENIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 330 LB.			
Arabula's Pet	J. and R. Williams, Crawford	8,766·25	526·617	Golden Boy
Nan 3rd of Woodlands	D. R. Hutton, Cunningham	8,456·48	373·541	Carnation Golden Duke
Rachel's Gem of Inverlaw	R. J. Crawford, Inverlaw	5,909·15	342·228	Linda 4th Millstream Noble 8th
	JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.			
Fauvic Flaremist	H. Cochrane, Kin Kin	6,294·89	319·847	Dreamlad of Glencoe
	SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.			
Peg of Newhills	J. Nicol Robinson, Maleny	5,256·4	337·95	Newhills Mascot
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Glenview Sultan's Crystal	F. P. Fowler and Sons, Biggenden	6,089·95	352·812	Caryle Larkspur 2nd Empire
Lady of Wingate	L. A. Pierce, Graceville	7,961·16	341·406	His Majesty of Dalebank
Golden Dewdrop of Golden Hill	Chas. Klaus, Mundubbera	5,389·75	275·452	Wattle Hero of Golden Hill
Lucy of Glenrow	F. Nimmo, Rosewood	6,059·5	267·927	Oxford Nero
	JUNIOR 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
Fauvic Double Joy	H. Cochrane, Kin Kin	5,001	290·204	Condong Double Prometheus
Bellgarth Pansy	D. R. Hutton, Cunningham	5,775·75	288·463	Bellefaire Blonde's Bellringer
Glenview Dainty	F. P. Fowler and Sons, Biggenden	5,118·25	287·021	Caryle Larkspur 2nd Empire
Nimbrae Sylvia	F. Nimmo, Rosewood	6,468	281·97	Oxford Raymond
Faith of Arranmore	J. Newman, Caboolture	4,693·4	254·414	Trinity Prince of Wales
Wyreene Olga	D. R. Hutton, Cunningham	4,256·75	232·29	Goldfinder's Prospect of Morago
Trecarne Silver 2nd	T. A. Petherick, Lockyer	5,832·41	355·346	Trecarne Golden King
Waveley Pretty Lady	D. R. Hutton, Cunningham	6,998·93	334·307	Oxford Gem's Noble 2nd
Glenview Victorious	F. P. Fowler and Sons, Biggenden	5,425	314·488	Trinity Officer
Nimbrae Fanny	F. Nimmo, Rosewood	6,027·5	310·504	Oxford Raymond
	AYRSHIRE.			
	SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.			
Fairview Lady Bess	R. M. Anderson, Southbrook	12,115·85	451·753	Longland's Bonnie Willie 2nd
Fairview Holly	R. M. Anderson, Southbrook	11,005·93	421·389	Longland's Bonnie Willie 2nd

Land for Grazing Selection.

MALVERN HILLS RESUMPTION.

TWO subdivisions of Malvern Hills resumption, situated from 24 to 36 miles south-westerly from Blackall, will be opened for Grazing Selection at the Land Office, Blackall, on Tuesday, 6th September, 1934.

One block, being portion 1, parish of Maindample, comprises an area of 22,220 acres, and will be opened for Grazing Homestead Selection, with a term of lease of twenty-eight years, at an annual rental of 4d. per acre for the first seven years of the term. This selection will require to be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years, and proof must be furnished of the financial standing and pastoral or land experience of the applicants.

The other block, being portion 3, parish of Granby, comprises an area of 17,745 acres, and will be opened for Grazing Farm Selection for a term of lease of twenty-eight years, at an annual rental of 2¼d. per acre for the first seven years of the term.

Each selection must be enclosed, within three years from the date of the license to occupy, with a fence which is both rabbit-proof and marsupial-proof.

The whole area of the resumption comprises black and brown soil downs country with gidyea forest and scrub.

Portion 1 is sufficiently watered naturally, and portion 3 has a sufficient supply of artificial and natural water.

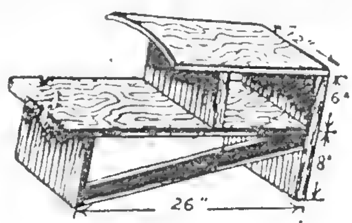
The other improvements consist of fencing.

The improvements on portion 1 are valued provisionally at £1,305, and on portion 3 at £1,425.

Free lithographs and full particulars may be obtained from the Land Agent, Blackall; the Land Settlement Inquiry Office, Brisbane; and the Government Intelligence and Tourist Bureaux, Sydney and Melbourne.

MILKING STOOL.

A stool can be easily made that will do away with holding the pail between the knees, and that will prove to be of a real aid to the milker. About 7 feet of 1 by 12 material will be sufficient; white or soft pine is advised, as it is light and is not



easily splintered. Saw up the material you have selected into the following lengths:—One 26 inches, one 18 inches, one 6 inches, one 8 inches, and the back board 14 inches. One end of the 18-inch board should be shaped to fit the curve of the pail. The stool should be braced to keep it rigid. When the carpentering part of the job is done, paint may be applied to preserve the wood and to make the stool more attractive.

Sugar Levies.

(Abbreviated Notice.)

1934 SEASON.

Regulations under "*The Primary Producers' Organisation and Marketing Acts*, 1926 *to* 1932," have been approved, providing for levies on suppliers of cane to sugar-mills at the following rates for the season 1934 (the figures for 1932 and 1933 are given for comparison purposes) :—

Name of Mill.	General Levy by Queensland Canegrowers' Council.	Administrative Levy by District Executive.	Administrative Levy by Mill Suppliers' Committee.	Special Levy by Mill Suppliers' Committee.	Total Levies for 1934.	Total Levies for 1933, given for comparison.	Total Levies for 1932, given for comparison.
	d.	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*
Mossman Central	$\frac{3}{4}$	2	..	..	$2\frac{3}{4}$	$2\frac{3}{4}$	$3\frac{1}{4}$
Hambledon	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{1}{4}$	..	$1\frac{3}{8}$	$1\frac{3}{8}$	$1\frac{1}{4}$
Babinda Central	$\frac{3}{4}$	$\frac{3}{8}$	..	..	$1\frac{1}{8}$	$1\frac{1}{8}$	1
Mulgrave Central	$\frac{3}{4}$	$\frac{3}{8}$	..	..	$1\frac{1}{8}$	$1\frac{1}{8}$	1
South Johnstone Central	$\frac{3}{4}$	$1\frac{1}{2}$	..	..	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$
Goondi	$\frac{3}{4}$	$1\frac{1}{2}$	..	..	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$
Mourilyan	$\frac{3}{4}$	$1\frac{1}{2}$	$\frac{1}{4}$	..	$2\frac{1}{2}$	$2\frac{3}{4}$	$2\frac{1}{4}$
Tully River Central	$\frac{3}{4}$	$1\frac{3}{4}$	..	..	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{3}{4}$
Macknade	$\frac{3}{4}$	$\frac{5}{16}$	$\frac{5}{16}$	..	$1\frac{3}{8}$	$1\frac{3}{8}$	$1\frac{1}{4}$
Victoria	$\frac{3}{4}$	$\frac{5}{16}$	$\frac{5}{16}$	..	$1\frac{3}{8}$	$1\frac{3}{8}$	$1\frac{1}{4}$
Kalamia	$\frac{3}{4}$	..	$\frac{1}{2}$	..	$1\frac{1}{4}$	$2\frac{1}{4}$	$1\frac{1}{4}$
Pioneer	$\frac{3}{4}$	..	1	..	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$
Inkerman	$\frac{3}{4}$	..	$\frac{1}{2}$	..	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$
Invicta	$\frac{3}{4}$	..	$1\frac{1}{2}$	..	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$
Proserpine Central	$\frac{3}{4}$	1	..	..	$1\frac{3}{4}$	2	2
Cattle Creek Central	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	..	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$
Plane Creek Central	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	..	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$
Marian Central	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{4}$	$2\frac{1}{2}$	$2\frac{1}{4}$	2
North Eton Central	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	..	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$
Pleystowe	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$
Racecourse Central	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	..	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$
Farleigh	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	..	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$
Qunaba	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{4}$	..	$1\frac{1}{2}$	$2\frac{1}{4}$	$1\frac{1}{4}$
Bingera	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	..	$1\frac{3}{4}$	$2\frac{1}{4}$	$1\frac{1}{2}$
Fairymead	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{4}$	..	$1\frac{1}{2}$	$2\frac{1}{4}$	$1\frac{1}{4}$
Gin Gin Central	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	..	2	$2\frac{3}{8}$	$1\frac{5}{8}$
Millaquin	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{4}$	..	$1\frac{1}{2}$	2	$1\frac{1}{4}$
Isis Central	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{4}$	..	$1\frac{1}{2}$	2	$1\frac{1}{4}$
Maryborough	$\frac{3}{4}$	1	..	..	$1\frac{3}{4}$	$2\frac{1}{4}$	$1\frac{1}{8}$
Mount Bauple Central	$\frac{3}{4}$	1	..	..	$1\frac{3}{4}$	$2\frac{1}{4}$	$1\frac{1}{8}$
Moreton Central	$\frac{3}{4}$	$\frac{1}{4}$	1	$\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{4}$	$2\frac{1}{4}$
Rocky Point	$\frac{3}{4}$	$\frac{1}{4}$	$\frac{3}{4}$	..	$1\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$
Eagleby	$\frac{3}{4}$	$\frac{1}{4}$	..	..	1	..	..

No poll will be taken in respect of the General Levy of $\frac{3}{4}$d. per ton (first column) for the Queensland Cane Growers' Council, or for the administrative levies by District Executives or Mill Suppliers' Committees (second and third columns).

In the fourth column, the levies on cane supplied to the Marian Central, Pleystowe, and Moreton Central Mills will be used in defraying the costs of employing farmers' representatives at those mills for the current season. In the case of these levies, growers may petition for a poll, and the petition must be signed by at least 100 or 50 per cent. (whichever shall be the less) of the cane suppliers to the three mills concerned.

In addition to the foregoing levies, the undermentioned Mill Suppliers' Committees are empowered to make particular levies on growers within each of the following districts, at the following rates :—

Name of Mill Suppliers' Committee and Mill to which Cane is Supplied.	Description of District or Cane on which Levies will be made.	Amount of Levy per ton of Cane Supplied.	Purposes of Levy.
		d.	
Racecourse Central	All cane grown on lands assigned to the Racecourse Central Mill and loaded at the Mount Ossa Railway Siding and supplied to the Racecourse Central Mill	3	To be used for financing a farmers' representative at the Racecourse Mill in the interests of the growers paying such levy.
Isis Central ..	Pialba district within the boundaries of the parishes of Urangan, Vernon, and Bingham, county March	1½	To be used for administrative purposes by Pialba Branch of Isis Central Mill Suppliers' Committee.
Isis Central ..	All cane consigned on the railway from Booyal, Junion, and Marule Sidings on the Dallarnil Railway	¼	To be used for administrative purposes by Booyal Branch of Isis Central Mill Suppliers' Committee.
Isis Central ..	All cane delivered in the Cordalba, Huxley, South Isis, North Isis, Childers, Doolbi, and Horton areas.	¼	To be used for administrative purposes by Isis Branch of Isis Central Mill Suppliers' Committee.
Mount Bauple Central	Mount Bauple district within the boundaries of the parishes of Gundiah, Tiaro, Gootchie, Curra, and St. Mary	¼	To be used for administrative purposes by Mount Bauple Branch of Mount Bauple Mill Suppliers' Committee.
Mount Bauple Central	Yerra district within the boundaries of the parishes of Gungaloon, Denison, Doongul, Woocoo, and Young	¼	To be used for administrative purposes by Yerra-Mungar District Branch of Mount Bauple Mill Suppliers' Committee.
Maryborough ..	Pialba district within the boundaries of the parishes of Vernon, Urangan, and Bingham, county March	½	To be used for administrative purposes by Pialba District Branch of Maryborough Mill Suppliers' Committee.
Maryborough ..	Maryborough district within the boundaries of the parishes of Tinana, Maryborough, Bidwell, Elliott, Young, and Walliebum, county March	¼	To be used for administrative purposes by Maryborough District Branch of Maryborough Mill Suppliers' Committee.

Growers are given the opportunity of petitioning for a poll to decide whether or not the above levies shall be made. The petition must be signed by at least 100 or 50 per cent. (whichever shall be the less) of the cane suppliers within any of the areas concerned.

All petitions must reach the under Secretary, Department of Agriculture and Stock, Brisbane, not later than 23rd July, 1934.

Full particulars of these Regulations appear in the *Government Gazette* of the 23rd June, 1934, or may be obtained on application to the managers of the various sugar-mills in Queensland or to the undersigned—

E. GRAHAM, Under Secretary,
Department of Agriculture and Stock,
Brisbane.

Answers to Correspondents.

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. Cyril T. White, F.L.S.

Useful Native Grass (*Echinocloa Colona*).

O.L.H. (Mareeba)—

The specimen of grass has been identified as *Echinochloa colona*, a native grass with a good reputation as a fodder.

Early Spring Grass.

J.L. (Jackson, Q.)—

The specimen is a species of *Eriochloa* or Early Spring Grass. The genus *Eriochloa* is represented in Queensland by several species. It is under review at the present time, and we find it rather hard to give specific names. However, they are all exceptionally good fodder grasses, much relished and readily eaten down by stock, and grow for the most part during the early spring and summer months. It is certainly a valuable grass in the mixed native pasture, but you will have to rely on natural means of spread, as seed is not obtainable through the ordinary commercial channels.

Silky Oak.

E.C.M. (Ingham)—

The common Silky Oak (*Grevillea robusta*) is very easy of propagation and growth, and if you are raising plants on a large scale you would find it much cheaper to raise them from seed than to purchase plants in pots. The seed is very light, but germinates if kept in special beds or flats in light sandy soil and lightly covered with about ¼ inch or a little more of soil. When a few inches high the seedling plants can be pricked off into pots or tubes. In the Queensland Forestry Department galvanised iron tubes are used for most of their planting, the tubes being split on one side and fastened with a clasp. When the young plant has made fair root development the clasp is undone, and the young plant slid into the prepared hole without the roots being disturbed. Chinese market gardeners and others sometimes adopt the same principle with tomato plants in jam tins, the tin being cut down one side and tied with string. Later the string can be cut and the plant transplanted without any disturbance of the root system. Of course, there is no bottom to the tins or tubes. The common Silky Oak is the old Silky Oak of the trade of Southern Queensland and Northern New South Wales. The Silky Oak of the Atherton Tableland and other parts of North Queensland is a totally different tree, most of the timber coming from *Cardwellia sublimus.* Seedlings can often be picked up in great abundance on the floor of the northern jungles. If you require further information about soil, the distance apart to plant, pruning, &c., to yield the best timber, we would advise you to write to the Secretary, Forestry Sub-department, Department of Public Lands, Brisbane.

Smartweed.

H.C. (Mackay)—

The specimen is *Polygonum minus*, one of the commonest Smartweeds in Queensland. Smartweeds on the whole, so far as we have observed, are more or less neglected by stock. When they are eaten, however, they are said to cause inflammation of the bladder and the digestive tract. Records of poisoning of stock by Smartweeds are very conflicting, and some veterinarians record the fact that they have fed the plants in quite large quantities without any ill effects following. The symptoms as given by you do not suggest poisoning by this plant, and your letter is being referred to the Chief Inspector of Stock for further advice.

Galvanised Burr; Mintweed.

S.C.L. (Brisbane)—

The Galvanised Burr is botanically known as *Bassia Birchii.* It is a native of Western Queensland and New South Wales. It is unpalatable to stock, and is one mass of seeds which are easily carried about. On this account it has overrun large areas of heavily stocked county in Western Queensland, and has become particularly abundant on some of the main stock routes. It is a spreading, intricately branched, somewhat woody plant about 2 to 3 ft. high. The stems and leaves are clothed with a white cottony wool, which tends to disappear from the older parts. The leaves are quite small, mostly under half an inch long. The burrs are exceedingly numerous, one being borne practically in the axil of each leaf. They are densely clothed with cottony wool, and are armed with five slender, unequal spines, the longest spine on the older burrs being usually about one-third of an inch long. Each burr contains one or perhaps two seeds.

Mintweed is botanically *Salvia lanceolata,* and is a native of the United States and Mexico. It is a strong-smelling, much branched annual weed, the young parts clothed with short stiff hairs. The stems are angular. The leaves are densely clothed on the under surface with short stiff hairs, and are mostly 1 to 2 inches long and about a-quarter inch wide. The flowers are blue, and are either opposite or borne in whorls of three or four in slender terminal spikes. The ovary in the centre of the flower is four-lobed, and when ripe develops into four pale straw-coloured nutlets or seeds.

Johnson Grass.

F.T. (Charters Towers)—

Johnson Grass is poisonous, and the roots, or rather the underground stolons, which are white and succulent, have been the cause of deaths of both cattle and pigs. Johnson Grass is distinguished by the possession of these long, white underground runners. Soudan Grass is similar to it, but is of a finer growth and of annual character.

Another grass with which both are confused is *Sorghum verticilliflorum.* This particular one is extremely poisonous, perhaps the worst of the three. It is a strong-growing grass, fairly common in some parts, of a perennial character, arising from fresh buds at the base every year. Johnson Grass and Soudan Grass, I may mention, are both Sorghums. The former is *Sorghum halipense,* the latter *Sorghum sudanense.* The best plan would be for you to send specimens of the plants supposed to have caused the trouble.

The Mulgas.

D.C. (Eulo)—

The common Mulga extends through Queensland, New South Wales, and South Australia right over to Western Australia. As is natural in a tree of such a wide range, it shows considerable variation. In Western Australia and South Australia a few trees other than the common Mulga (*Acacia aneura*) are called Mulga with some prefix, such as Desert Mulga, Irishman's Mulga, &c. In Queensland, however, all the Mulgas belong to the one species (*Acacia aneura*). It varies in stature and width of leaf, and there is a good deal of confusion about the fodder value of the different forms; in some localities the broad-leaved form being considered the better, and in others the narrow almost round-leaved varieties being considered the best.

Mr. C. J. McMaster, when chairman of the Western Lands Board, forwarded for publication to Mr. J. H. Maiden, then Government Botanist in New South Wales, a few notes on the different forms of the common Mulga in North-western New South Wales, and his remarks probably apply to South-western Queensland. He distinguished four different kinds—namely, the Umbrella Mulga, a narrow-leaved form growing on hard, stony ground, and generally considered excellent feed for stock; the broad-leaved Mulga, a form growing in the valleys between stony ridges; the Black Mulga, a form with leaves small, dark, and narrow; the Yellow Mulga, the common form on the red, sandy, typical Mulga soils, and generally regarded as the best of the Mulgas; it commonly has a somewhat yellowish tinge in the foliage.

Intermediate forms between these different kinds occur, and in some districts a large number of Mulgas are recognised, though they are not given distinctive names.

Plants from South Burnett Identified.

S.L. (Tingoora)—

(1) *Vittadinia australis,* a common weed of the family *Compositæ.* We have not heard a common named applied to it, and it is not known to possess any particular properties, useful or otherwise.

(2) *Euphorbia pilulifera,* Asthma Weed or Asthma Plant, a very common weed in Queensland. The dried leaves are made into tea and used fairly extensively to give relief in asthma; hence the local name. We think, however, that the effects of the plant wear off after a certain time, the system becoming more or less used to it.

(3) *Chenopodium carinatum,* a very common weed in Queensland. We have not heard a local name applied to it. It contains a prussic-acid-yielding glucoside, but we cannot say we have ever observed it to be eaten by stock to any extent, certainly not in sufficient quantities to cause trouble.

(4) *Solanum nigrum,* Garden Nightshade. The ripe berries are freely eaten by children, and are sometimes used for cooking without any ill-effects following. Occasionally trouble is experienced from the plant, and this is probably due to the berries being eaten in an unripe condition. They contain the poisonous principle Solanin, which tends to disappear as the berries ripen.

(5) *Stachys arvensis,* Stagger Weed, also called Wild Mint or Mintweed, but not to be confused with the Mintweed that has been given a good deal of prominence in the Press during the last couple of years. It causes ''staggers'' or ''shivers'' in working or travelling stock, but ordinary paddock stock eat the plant with impunity.

(6) *Gallinsoga parviflora.* Yellow Weed, and sometimes called Chick Weed, though this latter name more correctly belongs to another plant.

(7) *Euphorbia Drummondii,* Caustic Creeper, a very common weed in Queensland. On the whole, paddock stock, when they do eat the plant, seem to suffer little or no ill-effects from it. With travelling stock, however, much trouble has been reported. In New South Wales tests with the plant have on many occasions given a positive reaction for the presence of a prussic-acid glucoside, but repeated tests with Queensland specimens have always given negative results, and the symptoms described by experienced stock-owners in Queensland are certainly not those of prussic-acid poisoning. The head and neck of affected animals swell considerably. If the swelling is pierced an amber-coloured fluid exudes, and the life of the beast may be saved.

(8) *Oxalis corniculata,* Wood Sorrell.

(9) *Rumex Brownii,* Dock.

(10) No flowers, but we should say *Geranium dissectum,* Crow-foot; an excellent pasture plant, sometimes known as Wild Carrot, though this name more correctly belongs to a different herb. It is especially favoured by sheep.

Red Ash.

F.A.B. (Marmor)—

The specimen is the Red Ash (*Alphitonia excelsa*), a very common tree, widely distributed in Queensland and New South Wales. Stock, particularly horses, are very partial to it, and it is an excellent drought fodder. In addition to Red Ash, it is sometimes called Silver Leaf, Silver Wattle, White Ash, and other names, though, of course, it is not related to the true Wattles in any way, and belongs to a family of plants known as the *Rhamnaceæ.* Red Almond is the name adopted by the Forestry Department for the timber of this and some allied species. The leaves are somewhat saponaceous, and are commonly used by school children as a substitute for soap.

The Clove Tree.

W.G. (Cairns)—

We do not know of any Clove Tree in Australia, and you would have to import plants. The tree is rather difficult of propagation, and it is a few years before the first crop is borne. The present seat of the industry is at Zanzibar, which supplies about 90 per cent. of the world's requirements. It is possible you could obtain seeds or plants from some tropical nurseryman at Java, and if you write to the Director, Botanic Gardens, Buitenzorg, Java, Dutch East Indies, he may put you in touch with someone.

A Common BeachTree (*Ochrosia*).

E.C.D. (Townsville)—

The specimen is a species of *Ochrosia*, and we should say *Ochrosia elliptica*, a very common beach tree in parts of North Queensland and the islands of the Pacific. It is very common on some of the islands, such as Hayman Island, and is very noticeable on account of the great quantity of bright-red fruits it bears. So far as we know, these fruits are not edible, though we have no definite information on this point. The plant belongs to a poisonous family, the *Apocynaceæ*, and must therefore be looked on with suspicion. We have often noticed, however, that the fruits on the ground have been eaten to a limited extent by wild animals and birds. We do not know of a common name for the plant.

Red Flowering Gum.

L.G. (Toowoomba)—

We do not remember having seen the red-flowering Gum grafted on another stock. The plant is so readily raised from seed, and comes fairly true to type, that the practice of grafting plants is not resorted to. If you wish, however, to try your hand at grafting the red-flowering Gum on some of the Eucalypts about Toowoomba, the closest allies of the red-flowering Gum growing in your district are the Bloodwood, Spotted Gum, and Moreton Bay Ash. We should think trees about half an inch in diameter could be taken, and this month would probably be as good a time as any to do the work.

Flannel Weed.

A.J.E. (Brisbane)—

The specimen forwarded is the Flannel Weed, *Sida cordifolia*, a plant widely spread as a weed in most tropical and subtropical countries, including Central and North Queensland. It has been established in North Queensland for many years, particularly about some of the northern towns, such as Townsville and Cairns, and of late has spread more south, though in the more southern parts it does not seem to be the pest it is in the North. Arsenical sprays could be used in its eradication, but, of course, these are impracticable where stock are running, and in any case a certain amount of danger is always incurred when weeds are sprayed in stock country, even though reasonable caution may be used. Hand-pulling is rather expensive, but most of these *Sida* weeds, such as *Sida retusa* and the present species, can be kept down by several mowings. Scything would have to be done several times before the rootstock was exhausted. The plant possesses no harmful properties, not being poisonous to stock in any way.

Pimpernel.

G.R.I. (Gympie)—

The specimen bore neither flowers nor seeds, and in such cases it is difficult to name with certainty, but we should say it is the common Pimpernel (*Anagallis arvensis*). It is not a member of the Pea family, but from the name "Blue Pea" it is probably the blue flowered form. The plant is definitely poisonous, but on the whole is unpalatable to stock. Dr. Gilruth stated that the plant was responsible for the death of a large number of sheep in Victoria, apparently acting as a narcotic poison. The only case of definite poisoning by it that has come under our notice in Queensland was at Buderim Mountain, from where we received a quantity of seeds of the plant with the report that they were abundant in the paunch of a cow that had died from plant poisoning.

Trees for the West.

INQUIRER (Brisbane)—

Your specimen is *Codonocarpus cotinifolius*, the Bell Fruit, a native of Western Queensland and the neighbouring States. It occurs in the northern parts of South Australia, where it is generally known as Native Poplar. Regarding trees for the West, the following are some suggestions:—Bottle Trees, both narrow and broad leaved varieties; Currajong; Parkinsonia Tree; *Albizzia Lebbek*, commonly known in Western Queensland as Acacia; White Cedar; Pepper Tree; *Celtis sinensis*, commonly called Portuguese Elm; the Citron-scented Gum; Narrow-leaved Ironbark; *Bauhinia Hookeri*; Phytolacca or Bella Sombra Tree; *Acacia arabica;* Camphor Laurel; Pittosporum; and Algaroba Bean.

Water Gum. Tea Tree.

H.I.J. (Nundah)—

The Water Gum is *Tristania exiliflora*. This species is very common along watercourses in Eucalyptus country in North Queensland.

The Tea Tree is *Melaleuca linariifolia*. The principal constituents of the oil of this tree, according to Penfold, are terpinene, cymene, cineol (16-20 per cent), a terpineol, sesquiterpenes, &c. These constituents have been shown to have a high germicidal value. The oil from the species in Southern Queensland is being extracted in some cases.

Sunrise and Moonrise at Mackay and Warwick.

M.J.O'D. (Sarina)—

Your question as to the difference between the rising and setting times of the sun and moon at Mackay, as compared with Warwick, was referred to the Surveyor-General, Mr. J. P. Harvey, who advises as follows:—

SUN.

Warwick. 1934.	Rise. h. m.	Set. h. m.	Mackay. 1934.	Rise. h. m.	Set. h. m.
June 22	6 43	17 4	June 22	6 39	17 29
Dec. 23	4 53	18 49	Dec. 23	5 19	18 45

MOON.

Warwick. 1934.	Rise. h. m.		Set. h. m.	Mackay. 1934	Rise. h. m.		Set. h. m.
Jan. 26	15 41	Jan. 27	1 51	Jan. 26	15 33	Jan. 27	2 21
Feb. 10	0 44	Feb. 10	15 28	Feb. 10	1 14	Feb. 10	15 20

Note.—The table uses the 24-hour divisions—thus, 17h. 4m. equals 5.4 p.m.

The times of rising and setting of the sun are given at both solstices—that is when the sun is at its maximum northern and southern positions. Similarly, the moon is at its maximum northern and southern positions on 26th January and 10th February respectively. An examination of the table will show the range of differences between the two places.

Scours in Calves.

INQUIRER (Brisbane)—Mr. K. S. McIntosh, B.V.Sc., Animal Health Station, Yeerongpilly, advises: This case may be due to—

(1) The sudden change in diet from whole to skim milk. This process should be carried out gradually. The skim milk should be fresh and free from froth. Up to half a pint of lime water to each gallon of milk will assist digestion. The milk should be fed at blood heat.

(2) Bacteria or germs present in the bowel causing white scour, red scour, or blood scour. White scour usually affects animals up to ten days old, while blood scour generally attacks them when over fourteen days. Whichever form is present, it should be regarded as contagious, and healthy animals running in the same pen may pick up the disease from droppings, &c.

Infection may take place through the navel at or shortly after birth or be sucked from the dirty teats of the mother. Treatment is often not worth while, particularly in severe cases.

PREVENTIVE MEASURES.

(1) Discard old pens and yards and build new ones which will not receive drainage from the old ones. Only place new healthy calves in new pens.

(2) Isolate healthy from scouring calves.

(3) Scrub all feeding utensils with soda and scald well.

(4) Permit cows to calve in a clean dry paddock, and allow the calf to suck its mother as long as possible.

(5) Tie the navel as soon as possible after birth with a piece of tape dipped in tincture of iodine. Cut off the navel cord below the tape and swab stump with tincture of iodine.

(6) If calves are taken away from mother soon after birth feed on warm whole milk for at least two weeks. Feed little and often and change gradually on to skim milk. Keep all utensils scrupulously clean.

(7) Add half a pint of lime water and one teaspoonful of formalin to each gallon of milk fed. If calves show signs of constipation discontinue the formalin and, if necessary, replace it with castor oil.

Mat Grass.

W.F. (Traveston)—

The specimen of grass is Mat Grass or Carpet Grass (*Axonopus compressus*). Two forms of the Carpet Grass occur in Queensland, a broad-leaved form and a narrow-leaved form, and your specimen represents the latter. This is now generally regarded as the inferior of the two. Mat Grass has occasioned some concern on parts of the North Coast line on account of its invading Paspalum pastures, and requests have been received to have it declared a noxious weed. The Department has not recommended that such action be taken because, although Mat Grass is certainly a very objectionable grass when it comes into Paspalum pastures, it nevertheless has a certain value on second-class country. There are several quite large pastures of Mat Grass in coastal Queensland, and the enforcement of the Act, if the plant were declared a noxious weed, would be almost impossible. Where Mat Grass makes its appearance in a Paspalum or Rhodes Grass pasture it decreases very much the carrying capacity of the pasture, and its eradication should be attempted. The best way would be to plough the infested area and resow with Paspalum, Kikuyu, Giant Couch (*Brachiaria mutica*) or Rhodes, and so smother the Mat Grass. A pasture so treated would, of course, have to be given a spell from stock.

In answer to a correspondent, Mr. Cyril White has supplied the following notes:—

Noogoora Burr—

After the heavy spring and early summer rains there was a prolific growth of seedlings of the Noogoora Burr this season, and one or two cases of poisoning by the seedling plants were brought under the notice of the Department of Agriculture and Stock. It does not seem to be generally known that Noogoora Burr is poisonous when quite young and still bearing the seed leaves. The plant probably loses its toxicity, however, when a few weeks old.

The Noogoora Burr is a robust annual weed up to 6 feet or more high, the female flowers eventually forming hard, woody burrs which, when ripe, are about 1 inch long and densely covered with hooked spines. These burrs contain two seeds, one of which usually germinates one year, and the other the following. It is a native of North America, and is supposed to have been introduced into Queensland with cotton seed from that country about seventy years ago.

The genus *Xanthium* consists of twenty-five distinct species, and according to Dr. F. J. Widder, who has recently written a complete account of them, the Queensland plant is *Xanthium pungens*. In the United States and Canada the Noogoora Burr and its allies are known as Cockle Burrs. They are there recognised as being poisonous in their seedling stage, but United States authorities state that experimental work has shown that beneficial results follow the administration of oils and fats to affected animals. For this purpose linseed oil, bacon grease, or lard can be used.

The Entomological Branch of the Department of Agriculture and Stock, acting on behalf of the Council for Scientific and Industrial Research, has recently liberated in Queensland a number of colonies of the Noogoora Burr Seed Fly (*Euaresta aequalis*). This parasite has been introduced from Kansas, and its effect on the distribution of the pest is awaited with interest.

Wild Mint—

Wild Mint (*Salvia reflexa*, previously recorded as *Salvia lanceolata*) is somewhat on the increase, and has been recorded from a few fresh localities. For those who are unacquainted with this plant it might be mentioned that it is a strong-smelling, much-branched annual weed. The leaves are densely clothed on the under surface with short, stiff hairs, are mostly 1 or 2 inches long and about ¼ inch wide. The flowers are borne in spikes, are blue, and about ⅓ inch long. The ovary borne in the centre of the flower is four-lobed, and develops later on into four pale-straw coloured nutlets or seeds.

It is a native of the United States and Mexico. No definite cases of poisoning by it have come under the notice of the Department of Agriculture and Stock during the past season. Losses from it are mainly in travelling stock, ordinary paddock stock seeming to feed among the plant taking an occasional bite without any ill effects following.

Galvanised Burr—

The Galvanised Burr (*Bassia Birchii*) has spread very much on stock routes and on closely settled country. It is the general opinion held by both pastoralists and officers of the Department of Agriculture and Stock that a good growth of grass will in one or two seasons choke out the Galvanised Burr, but during the past season this does not seem to have been borne out by facts, and the plant seems much on the increase.

Though most abundant in the West, it is commonly seen in more coastal localities, seeds having dropped from sheep trucks, and is now and again met with as a weed on coastal fruit farms where scrapings from sheep trucks are used as manure.

For those unacquainted with the plant, it might be mentioned that it is a spreading, intricately branched, somewhat woody weed about 2 to 3 feet high. The stems and leaves are clothed with a white cottony wool, more or less disappearing from the older parts. The leaves are small and mostly under ½ inch long. The burrs are exceedingly numerous, one being borne practically in every leaf axil. Each burr bears mostly one seed, and as they are borne in great abundance the plant is easily spread from one place to another.

Weir Vine—

The Weir Vine has attracted some considerable attention during the past twelve months owing to the rapidity with which it is spreading in parts of the southern Maranoa. The Weir Vine is a creeping plant, the roots producing large underground Sweet Potato-like tubers. The leaves are fairly large, sometimes over 4 inches across. The plant is a member of the *Convolvulaceæ* or Morning Glory family, and the flowers are large, about 3 inches long; they mostly come out pinkish-red and turn to blue. The seed capsules are rather large, being about ¾ to 1 inch in diameter, and contain several blackish angular seeds.

The botanical name of the Weir Vine is *Ipomœa calobra*, the specific name *calobra* being given to it on account of its being known to the aborigines on the Barcoo as Calobra. It is most abundant in Queensland in the hard red soils of the southern Maranoa.

The importance of the plant lies in the fact that stock that take to it become affected in much the same way as those affected by Indigo or Darling Pea. They have a wild staring look in their eyes. Cattle will try to catch their tails, and in bad cases they go in the loins. Horses are affected in much the same way. They rear up, try to climb trees, &c., and sometimes so injure themselves that they have to be destroyed. Some stockowners think it is the pods that cause the damage and not the leaves only, but on this point we have no definite information.

The large underground tubers are quite harmless, and were used as food by the aborigines. Some white people who have used them say that when cooked they do not taste badly. They are evidently quite harmless raw, because bushmen often chew or suck the raw, rather juicy tubers to allay thirst.

A New Grass Genus.

E.H.B. (Miles)—

You may remember that when Mr. Hubbard was in Queensland you sent down specimens of a grass which was quite new to us and which did not agree with anything previously in our collections. It will interest you to know that Mr. Hubbard has now named this as a new genus of grasses under the name of *Homopholis*, and he has given the grass the name of *Homopholis Belsonii*. The specimens you collected at the head of Dogwood Creek, east of Gurulmundi, in November, 1930, are the only specimens we possess, but we expect to get a few more in from the Western Downs and Maranoa district before very long.

Woolly Finger Grass.

R.S.McK. (Mungallala)—

The Woolly Finger Grass (*Digitaria eriantha*) should grow quite well in your district. We think that it has a future in parts of the Maranoa and Western Darling Downs, particularly in sandy lands at present occupied by Spear grasses or short-lived summer species. If propagated by roots in the spring or early summer it should soon send out runners and establish itself, but stock, of course, would have to be kept off it for a few months until the grass became strong enough to stand feeding.

General Notes.

In Memoriam.

MRS. ALEXANDER ROBERT HENRY.

The many friends of Mr. Alec. Henry, the secretary of the Central Sugar Cane Prices Board, will regret to learn of the passing of his beloved wife, which sad event took place at her home at Clayfield, Brisbane, on Monday, 9th July. The late Mrs. Henry was in her usual good health on the morning of the day of her death, and after attending to her home duties, left for the railway station to fulfil an engagement in the city. While waiting for the train she was overtaken with a seizure and conveyed back to her home, where she gradually sank and passed away at midday. The deceased lady possessed a charming personality, and was associated with many charitable and social organisations. Her friendships encircled many people throughout the State who will mourn with her bereaved relatives in the loss of a splendid wife and mother. The funeral moved from her residence at Clayfield for the Nundah Cemetery on the following day, the long cortege consisting of representative men of the Department of Agriculture and Stock, including the Minister, the Hon. Frank W. Bulcock, the sugar industry, and the business life of Queensland. We extend our deepest sympathy to her sorrowing family in the tragic loss they have sustained.

Canary Seed Board.

The Canary Seed Board election resulted as follows:—

	Votes.
George Burton (Cambooya)	200
Garret Denis O'Neill (Allora)	199
Michael Coleman (Nobby)	149
Edwin Sylvester Maher (Allora)	90

Messrs. Burton and O'Neill are the present members of the Board, and will therefore be reappointed for a further term of one year as from the 1st June.

Trans-Border Stock Crossings.

Following an outbreak of ticks in New South Wales in close proximity to the Stanthorpe-Killarney area, an Order in Council has been issued placing certain restrictions on the introduction of stock at all crossing places between and including Wallangarra and east to Stanthorpe. This means that all cattle and horses entering the State must be provided with a certificate of health and freedom from ticks, and a certificate that they have been dipped or hand-dressed as prescribed within seven days before crossing. Also they must be found clean upon inspection at the crossing places, and again dipped or hand-dressed.

State Wheat Board.

A regulation has been approved under the Wheat Pool Acts, which will provide that the four representatives of wheatgrowers on the State Wheat Board appointed for the period from 1st September, 1933, to 31st August, 1934, may be appointed to be members of such Board for a further period not exceeding eight months, as the Minister shall think fit.

Staff Changes and Appointments.

The following have been appointed members of the Stallion Boards hereunder specified:—

East Moreton District Stallion Board.—Messrs. J. C. J. Maunder, B.V.Sc., Government Veterinary Surgeon (Chairman), W. Frood, and S. R. Watson.

Wide Bay District Stallion Board.—Messrs. A. F. S. Ohman, M.V.Sc., Government Veterinary Surgeon (Chairman), R. J. F. O'Bryen, and G. Elliot.

Burnett District Stallion Board.—Messrs. A. F. S. Ohman, M.V.Sc., Government Veterinary Surgeon (Chairman), R. J. F. O'Bryen, and G. Elliot.

Central Coast District Stallion Board.—Messrs. J. C. J. Maunder, B.V.Sc. (Chairman), W. C. Jeffery, and J. Sprott.

Northern Coast District Stallion Board.—Messrs. A. F. S. Ohman, M.V.Sc. (Chairman), M. F. Yore, and R. Tait.

Miss D. Bowder, Assistant Cane Tester at Inkerman Mill, has been transferred to the position of Cane Tester at Maryborough Mill in lieu of Miss D. Marles, resigned. The following Assistant Cane Testers have also been appointed:—Miss A. Smith (Cattle Creek Mill), Mr. A. R. Hughes (Inkerman), Mr. F. P. Mulligan (Invicta), Miss A. L. Dahl (Isis), Mr. E. J. Delaney (Kalamia), Miss P. Eadie (Qunaba).

Messrs. R. Lauder (Tully) and H. B. Randall (Facing Island, Gladstone) have been appointed Honorary Rangers under the Animals and Birds Acts.

Acting Sergeant C. P. Murray, Jundah, has been appointed also an Inspector under the Brands Acts.

Constable J. Geraghty, of Injune, has been appointed also an Acting Stock Inspector and Inspector of Brands.

The Officer in Charge of Police, Eton, has been appointed also an Acting Stock Inspector.

Messrs. A. Menkins, A. E. Bonnet, and V. B. Martin have been appointed Assistant Cane Testers at the Cattle Creek, Invicta, and Plan Creek Sugar Mills, in lieu of Miss A. Smith, Mr. F. P. Mulligan, and Miss E. A. Crees, who have resigned.

The Council of Agriculture.

An Order in Council has been issued in pursuance of the provisions of the Primary Producers' Organisation and Marketing Acts, declaring the number of members of the Council of Agriculture to be twenty-eight. A regulation has also been issued prescribing the members of Commodity Boards who shall be members of the Council. These include two members of the Butter Board, Messrs. J. McRobert (Maryborough) and W. J. Sloan (Malanda), and one member each of the remaining Commodity Boards, Messrs. H. T. Anderson (Biddeston), Cheese Board; J. Beck (Stanwell), Cotton Board; L. R. Crouch (Atherton), Atherton Tableland Maize Board; C. Brumm (Woongoolba), Arrowroot Board; C. F. Adermann (Kingaroy), Peanut Board; R. V. Woodrow (Woodford), Honey Board; H. Kessler (Cambooya), Barley Board; A. McLauchlan (Boonah), Egg Board; H. Niemeyer (Hatton Vale), Broom Millet Board; G. D. O'Neill (Allora), Canary Seed Board; D. Johnston (Malanda), Northern Pig Board; and G. A. Duffy (chairman of the Timber Advisory Committee), Plywood and Veneer Board. The Committee of Direction of Fruit Marketing, the Queensland Cane Growers' Council, and the Wheat Board are also included, and their representatives are: Messrs. W. Ranger (Brisbane), G. Johnson (Mirani, Mackay), and W. J. Brimblecombe (Pirrinuan). The Minister for Agriculture and Stock (Hon. F. W. Bulcock) is President of the Council, and the Director of Marketing (Mr. E. Graham) is a member by virtue of his office.

Removal of Citrus Plants from Elimbah District Prohibited.

Owing to an outbreak of Brown Spot disease of mandarins in the Elimbah district, a Proclamation has been issued under the Diseases in Plants Acts, prescribing such district to be a quarantine area and prohibiting the removal of any citrus plants therefrom.

Pineapple Levy Regulations.

A regulation has been issued under the Fruit Marketing Organisation Acts empowering the Committee of Direction of Fruit Marketing to make a levy on all pineapples marketed for the year ending 19th August, 1935. The levy is similar to that of last year, namely:—

(*a*) On all pineapples sold or consigned whether by rail, road, or boat, to fruit-canners, at the rate of 1d. per case.

(*b*) On all pineapples sold or consigned by rail to agents, or others, except to factories, at the rate of 1s. 4d. per ton, with a minimum of 1d.

(*c*) On all pineapples sold or consigned otherwise than by rail to any Queensland railway station to any agent, or firm, except to factories, at the rate of ½d. per case, with a minimum of 1d.

Where sold loose, the levy shall be ½d. (with a minimum of 1d.) for 24 smooth leaf pineapples or 42 rough or ripley pineapples, as being equal to a case of fresh pineapples.

Every company or person carrying pineapples for any market other than for railing from any station, shall furnish a monthly return to the C.O.D. regarding the fruit carried.

The levy on all fruit railed from any Queensland railway station (except Toowoomba, Townsville, Rockhampton, Roma Street, Woolloongabba, Brunswick Street, South Brisbane, or Central Stations) to any other Queensland railway station, and not consigned to factories, may be collected by the Commissioner for Railways to the extent of 1s. 4d. per ton, with a minimum of 1d.

Subject thereto, and except as provided, the levy in the first instance shall be collected on all pineapples sold or consigned by rail or otherwise to factories by the C.O.D. at the rate of 1d. per case; on all fruit delivered otherwise than by rail to any railway station to any agent or person except a factory, by such agent or person at the rate of ½d. per case, with a minimum of 1d.

The sums raised by the levy shall be expended by the C.O.D. in the interests of the pineapple-growers.

Proposed Co-operative Flour Mill.

In the course of a recent Press statement, the Minister for Agriculture and Stock, Mr. Frank W. Bulcock, said that it was gratifying to him to note that definite steps had been taken towards the formation of a co-operative flour-milling company, and that this company was about to be registered under the Companies Act. Originally an application was made for registration under the Primary Producers' Co-operative Associations Acts, but those Acts require that shareholders shall be direct suppliers to the mill. With our pool system in operation, every producer is a direct supplier to the Board, and therefore only the Board can supply to the mill. This difficulty was not visualised when the original legislation was passed, but, as the Acts stand at the present time, the wheat farmers interested in the establishment of a co-operative mill are definitely debarred from participation under the Co-operative Associations Acts. However, said Mr. Bulcock, it was his intention to make certain recommendations involving an alteration in those Acts, in order that pool boards may be regarded as suppliers within the terms of those Acts. He anticipated that amending legislation would receive the early attention of Parliament.

Appeal against Declaration of an Abandoned Orchard.

Regulations have been issued under the Diseases in Plants Acts which provide that, when an occupier or owner of a piece of land who has received notice from the Minister that under the powers conferred by the abovementioned Acts it is intended to declare his orchard or nursery an abandoned orchard or nursery desires to appeal against such decision, the appeal must be lodged within a period of twenty-one days from the date of the notice by the Minister. The appeal must be made in a special form, as prescribed, to the Clerk of Petty Sessions for the Petty Sessions District in which the land concerned is situated. A notice of intention to appeal, in a specified form, must also be forwarded to the Minister. The Clerk of Petty Sessions shall fix a time and place for the hearing of the appeal, and shall notify the parties concerned.

Dairy Cattle Improvement Act, End of Controversy.

At a special conference of Dairy Companies of Queensland, convened by the Queensland Butter Board, the payment of the levy under the above Act was the principal matter discussed. Representatives of practically all the companies in Queensland were present, and a resolution was carried—Maryborough being the only dissentient—that the companies would pay the levies imposed under the Act.

The Maryborough company intimated acceptance of the resolution. This means that Maryborough will now make its contributions to the Butter Board.

Animal and Bird Sanctuaries Proclaimed.

The following sanctuaries have been declared in pursuance of the provisions of the Animals and Birds Acts:—Pig and Sheep Islands, in Noosa River; Mount Woorolin Park Reserve, Kingaroy; the property adjacent to the Town Common, Townsville, known as the Old Cluden Racecourse; and "The Plains," Boondooma, via Preston. It will, in future, be an offence to take or kill any animal or bird on the abovementioned properties.

The Tobacco Industry Portection Act in Force.

A Proclamation has been issued bringing into operation, as from 12th July, the Tobacco Industry Protection Act, a measure passed last session. Orders in Council have also been issued constituting districts and declaring certain diseases, pests, and fungi under the Act. Regulations to give effect to the provisions of the Act have been promulgated.

A number of Officers of the Department of Agriculture and Stock, including Field Officers of the Agricultural Branch, Inspectors under the Diseases in Plants Acts, and Officers of the Entomological Branch, have been appointed also Inspectors under the Tobacco Industry Protection Act.

An Order in Council under the Diseases in Plants Acts, relative to the eradication of tobacco plants, has been rescinded, as the Tobacco Act covers the destruction of old plants.

The Plywood and Veneer Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts, amending the constitution of the Plywood and Veneer Board by inserting a provision which will empower the Minister, upon the recommendation of the Board, to direct, by public notification in the *Gazette*, that no person shall deliver any plywood and/or veneer to the Board before the date mentioned in such notification. The following consequences shall ensue until the date mentioned:—Growers shall deliver to the Board each month, or at times decided by the Board, a return showing the total quantities of plywood and/or veneer manufactured during the preceding month, and the names and addresses of those to whom the commodities were delivered. Agents for the sale of the commodities shall deliver to the Board, when so required by the Board, returns showing the quantities of plywood and/or veneer sold by them during the preceding month, or term fixed by the Board, and the prices realised therefor. The Minister may appoint any person to inspect any books and accounts of growers or agents.

Banana Board.

An Order in Council has been issued under the Banana Industry Protection Act, providing for a levy on banana growers to be used for the maintenance of the Banana Industry Protection Board. The levy is the same as that imposed during the last few years, and is at the rate of 1½d. per case containing 1½ bushels or less for all bananas marketed in the case, and 2d. in the £ or part thereof on the proceeds of sales of all bananas marketed in the bunch. The levy will be effective for a period of twelve months as from 1st August next.

Regulations under the Dairy Products Stabilisation Act.

Regulations have been issued under "*The Dairy Products Stabilisation Act of 1933.*" These provide for the appointment of officers of the Dairy Products Stabilisation Board; the conduct of business at meetings of the Board; resolutions; vacancies on the Board; committees; and consultations with other Boards. Further, it will be necessary for manufacturers to keep registers of dairy products manufactured or processed. Provision is made for penalties and for prosecutions.

Orchard Notes for September.

THE COASTAL DISTRICTS.

SEPTEMBER is a busy month for the fruitgrowers in the coastal districts of this State, as the returns to be obtained from the orchards, vineyards, and plantations depend very largely on the trees, vines, and other fruits getting a good start now.

In the case of citrus orchards—especially in the southern half of the State—it is certainly the most important month in the year, as the crop of fruit to be harvested during the following autumn and winter depends not only on the trees blossoming well but, what is of much more importance, that the blossoms mature properly and set a good crop of fruit.

This can only be brought about by keeping the trees healthy and in vigorous growth, as, if the trees are not in this condition, they do not possess the necessary strength to set their fruit, even though they may blossom profusely. The maintenance of the trees in a state of vigorous growth demands—first, that there is an adequate supply of moisture in the soil for the requirements of the trees; and, secondly, that there is an adequate supply of the essential plant-foods available in the soil.

With respect to the supply of moisture in the soil, this can only be secured by systematic cultivation, except in seasons of good rainfall or where there is a supply of water for irrigation. As a rule, September is a more or less dry month, and when it is dry there is little chance of securing a good crop of fruit from a neglected orchard.

If the advice that was given in the Notes for August regarding the conservation of moisture in the soil has been carried out, all that is necessary is to keep the soil stirred frequently, so as to prevent the loss of moisture by surface evaporation. If the advice has been ignored, then no time should be lost, but the soil should be brought into a state of good tilth as quickly as possible.

Where there is a supply of water available for irrigation, the trees should receive a thorough soaking if they require it. Don't wait till the trees show signs of distress, but see that they are supplied with an adequate supply of moisture during the flowering and setting periods.

It is probable that one of the chief causes why navel oranges are frequently shy bearers in the coastal districts is that the trees, though they produce a heavy crop of blossoms, are unable to set their fruit, owing to a lack of sufficient moisture in the soil at that time, as during seasons when there is a good rainfall and the trees are in vigorous growth, or where they are grown by irrigation, as a rule they bear much better crops. The importance of maintaining a good supply of moisture in the soil is thus recognised in the case of this particular variety of citrus fruit.

When the trees show the want of sufficient plant-food—a condition that is easily known by the colour of the foliage and their weakly growth—the orchard should be manured with a quick-acting, complete manure, such as a mixture of superphosphate, sulphate of ammonia, and sulphate of potash, the plant-foods which are soluble in the water contained in the soil and are thus readily taken up by the feeding roots.

Although the foregoing has been written mainly in respect of citrus orchards, it applies equally well to those in which other fruit trees are grown. Where the land has been prepared for bananas, planting should take place during the month. If the plantation is to be made on old land, then the soil should have been deeply ploughed and subsoiled and brought into a state of perfect tilth prior to planting. It should also receive a good dressing of a complete manure, so as to provide an ample supply of available plant-food. In the case of new land, which has, as a rule, been scrub that has been recently fallen and burnt off, the first operation is to dig the holes for the suckers at about 12 ft. apart each way. Good holes should be dug, and they should be deep enough to permit the top of the bulb or corm of the sucker to be 6 in. below the surface of the ground.

Care should be exercised in the selection of suckers, butts, or bits. Either of the two latter are preferable, and in the case of suckers which have broken into leaf, these should also be cut hard down to the butt. Before planting, all roots should be cut off closely and the surface pared or scraped, excepting over the buds or eyes which

are allowed for development. Where the butts are split into sections (up to four) according to the number and placements of eyes, these are planted with the eye or eyes facing downwards. In the case of butts, two to three eyes are left spaced around the butt, and surplus ones being removed, the top having previously been cut down to the corm and the centre scored out. Better growth is evidenced in each case, and as no cut surface is made available (each "plant" being covered by a few inches of soil immediately) beetle-borer infestation is not shown.

In old banana plantations keep the ground well worked and free from weeds and remove all superfluous suckers; also all bases of plants which have fruited.

When necessary, manure—using a complete fertilizer rich in potash, nitrogen, and phosphoric acid, such as a mixture of meatworks manure and sulphate of potash —two of the former to one of the latter.

Pineapples can also be planted now. The ground should be thoroughly prepared —viz., brought into a state of perfect tilth to a depth of at least 1 ft.—more if possible—not scratched, as frequently happens; and when the soil requires feeding, it should be manured with a complete manure; which should, however, contain no superphosphate, bonedust or Nauru phosphate being preferable.

Old plantations should be kept in a good state of tilth and be manured with a complete fertilizer in which the phosphoric acid is in the form of bonedust, basic phosphate, or finely ground phosphatic rock, but on no account as superphosphate.

The pruning of custard apples should be carried out during the month, leaving the work, however, as late in the season as possible, as it is not advisable to encourage an early growth, which often means a production of infertile flowers. If the weather conditions are favourable passion vines can also be pruned now, as if cut back hard they will make new growth that will bear an autumn crop of fruit instead of one ripening during the summer.

Grape vines will require careful attention from the time the buds start, and they should be regularly and systematically sprayed with Bordeaux mixure from then till the time the fruit is ready to colour, in order to prevent loss by downy mildew or anthracnose. Sulphuring may be required against powdery mildew.

Where leaf-eating beetles, caterpillars, or other insects are present, the trees or plants on which they are feeding should be sprayed with arsenate of lead. All fruit-fly infested fruit must be gathered and destroyed and on no account be allowed to lie about on the ground, as, if the fly is allowed to breed unchecked at this time of the year, there is very little chance of keeping it in check later in the season.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

WHERE not already completed, the winter spraying with lime-sulphur should be finished as early in the month as possible. Black aphis should be fought wherever it makes its appearance by spraying with a tobacco wash, such as black-leaf forty, as if these very destructive insects are kept well in hand the young growth of flowers, leaves, wood, and fruit will have a chance to develop.

The working over of undesirable varieties of fruit trees can be continued. The pruning of grape vines should be done during the month, delaying the work as long as it is safe to do so, as the later the vines are pruned the less chance there is of their young growth being killed by late frosts. Keep the orchards well worked and free from weeds of all kinds, as the latter not only deplete the soil of moisture but also act as a harbour for many serious pests, such as the Rutherglen bug.

New vineyards can be set out, and, in order to destroy any fungus spores that may be attached to the cuttings, it is a good plan to dip them in Bordeaux mixture before planting. The land for vines should be well and deeply worked, and the cutting should be planted with one eye only out of the ground and one eye at or near the surface of the ground.

In the warmer parts, which are suitable for the growth of citrus fruits, the land must be kept well cultivated, and if the trees need irrigating they should be given a good soaking, to be followed by cultivation as soon as the land will carry a horse without packing.

In these parts fruit fly should be systematically fought, as it will probably make its appearance in late citrus fruits and loquats; and if this crop of flies is destroyed, there will be every chance of the early crops of plums, peaches, and apricots escaping without much loss.

Farm Notes for September.

WITH the advent of spring, cultivating implements play an important part in farming operations.

The increased warmth of soil and atmosphere is conducive to the growth of weeds of all kinds, particularly on those soils that have only received an indifferent preparation.

Potatoes planted during last month will have made their appearance above the soil, and where doubt exists as to their freedom from blight they should be sprayed with either Burgundy or Bordeaux mixture as soon as the young leaves are clear of the soil surface.

Land which has received careful initial cultivation and has a sufficiency of sub-surface moisture to permit of a satisfactory germination of seeds may be sown with maize, millets, panicum, sorghum, melons, pumpkins, cowpeas, broom millets, and crops of a like nature, provided, of course that the areas sown are not usually subjected to late frosts.

Rhodes grass may be sown now over well-prepared surfaces of recently cleared forest lands or where early scrub burns have been obtained, and the seed is sown subsequent to showers. More rapid growths, however, are usually obtainable on areas dealt with, say, a month later.

In connection with the sowing of Rhodes grass, farmers are reminded that they have the Pure Seeds Act for their protection, and in Rhodes grass, perhaps more than any other grass, it is necessary that seed of good germination only should be sown. A sample forwarded to the Department of Agriculture will elicit the information free of cost as to whether it is worth sowing or not.

Where the conditions of rainfall are suited to its growth, paspalum may be sown this month.

The spring maize crop, always a risky one, requires to be sown on land which has received good initial cultivation and has reserves of soil moisture. Check-row seeding in this crop is to be recommended, permitting as it does right-angled and diagonal cultivation by horse implements, minimising the amount of weed growth, and at the same time obtaining a soil mulch that will, with the aid of light showers, assist to tide the plant over its critical period of "tasselling."

Although cotton may be sown this month, it usually stands a better chance if deferred until October. The harvesting of cotton during the normal rainy season is, if possible, to be avoided.

The sowing of intermediate crops prior to the preparation of land for lucerne sowing should be carried out in order that early and thorough cultivation can take place prior to the autumn sowing.

The following subsidiary crops may be sown during the month:—Peanuts, sweet potatoes, arrowroot, cow cane, and in those districts suited to their production yams and ginger. Plant out coffee.

Rural Topics.

Care of Breeding Sows.

To obviate loss of condition owing to excitement and fever during "oestrum" or the period sow pigs are "on heat" during the stages when mature sows are being prepared for the bacon factory, it is suggested that the sows be mated to the boar about one month before date when it is desired to market them. This procedure is described in some text-books as "settling the sow," which really means encouraging her to "top up" more readily and be ready for slaughter ahead of the date she would be ready if the period of oestrum interfered with her development. However, there is always a risk associated with this, for it may so happen, owing to bad weather, bad roads. or other happenings, that it may not be convenient to market the sows when one month in pig only. If they are advanced in pregnancy, and are definitely showing as in pig, there may be an objection on the part of the buyer to purchase, and in the end the in-pig sow may realise less and prove less profitable than the sow not in pig which has taken a week or two longer to reach the marketing stage. Young sows should not, of course, be mated, as in this case it is both unwise and unnecessary.

There is an old belief that the sow is more likely to prove in pig—i.e., to hold to the service of the boar if she is mated late on the second or early in the third day of the period of oestrum. This period of being "on heat" lasts for three days, and recurs every twenty-one days until the sow becomes pregnant. It is often difficult to detect signs of oestrum on the first day of its occurrence, but if at all possible it is advisable to mate again on the second or third day even if the sow is first mated on the first day of the period. It is preferable also to mate about three days after weaning of the litter at eight weeks. Actually the sow will come in season three days after farrowing, and every three weeks after that, but, as stated, mating should be deferred till weaning takes place if the sow is normal and has suckled a good litter. It is not advisable to defer mating any longer unless there are special reasons for so doing.

When the sow is coming in season—she invariably becomes excited—there is a distinct restlessness and a tendency to jump on the back of other sows. A sow may even become a fence-breaker, and may wander away a considerable distance looking for a mate, or she may become very stubborn and refuse to move if approached. It pays to exercise considerable care and to be very patient with the animals at that time. In-pig sows should not be permitted to graze together with those suckling litters or that are not in pig, as accidents may happen. The sows may fight or interfere with one another, or the boar may knock them about. He should not be allowed to run with them except on special occasions, and even then care should be taken to see that he does not injure the sows or young pigs or that the sows do not injure him, for they sometimes fight and injure one another.

When sucking pigs are four weeks old (some will commence earlier) they should be encouraged to feed apart from the sow, and for this purpose should be provided with a trough in a separate enclosure. In fact, they will be all the better for having good grazing or succulent green food in addition to the sows's milk. They also like charcoal, and love to lick a block of rock salt. These latter supply minerals which are very necessary in the development of their bony and muscular systems. As the strongest pigs of the litter are usually those which have regular access to the teats to the front of the sow's udder (the teats nearest the forequarter), it may be an advantage to wean them earlier than the smaller ones in the litter; hence if they are able to feed on their own as separate from the sow it will be all the better for them and will enable the breeder to "even up the litter" and give the smaller ones a better chance.

The practice of spaying sows—that is, of removing their ovaries (part of their breeding organs) for a similar purpose to that in view in castrating male pigs—is not advised under conditions such as those ruling in the marketing of pigs in this country. Sow pigs do not usually come in season to any extent before the sow is six months of age, and if she is being prepared for pork or bacon she should be marketed or be ready for market before six months old. Similarly it does not pay to spay older sows, for the operation is not only a difficult one but a risky one, and it takes the sow some time to recover and get back to normal. The spaying of sows is not practised at all in Australia, although castration of the male pigs is a regular practice on every pig farm.—E. J. Shelton, H.D.A., Senior Instructor in Pig Raising.

Heredity and Environment.

At the Carrick Agricultural Discussion Society (Scotland) recently, a lecture was delivered by Mr. A. D. Buchanan Smith, Institute of Animal Genetics, University of Edinburgh, on "Heredity and Environment."

Mr. Buchanan Smith said what an animal is or what it does is the outcome of two forces acting upon each other—heredity and environment. The force of heredity provides an animal with certain qualities. As to whether these qualities are to be developed to their utmost depends upon environment. Environment can, indeed, completely mask the existence of certain hereditary qualities. Practically every character in plants, animals, and man is to a greater or less extent conditioned by heredity. Some characters are practically entirely due to heredity, with environment playing little or no part in their expression. An instance of this may be found in coat colour. The mode of the inheritance of coat colour in cattle affords an excellent example of some of the ways in which heredity works.

If we mate a black Aberdeen Angus to a red Shorthorn the progeny are all black in colour, taking after the Aberdeen Angus parent. If we mate two of these crossbreds together we find that, while the majority of the calves from these crossbreds are black, about one-quarter of them are red. In the same way, while the first cross calves from Aberdeen Angus/Shorthorn parents are polled, the second cross consists largely of polled animals, but about one in four are horned. If we were to raise an infinitely large population of the second cross animals, we would find that the proportion that appeared either red or horned would be exactly one in four. When we are working with smaller numbers the proportion may be slightly different. It is like tossing a penny. If you toss a penny a thousand times, you will get very nearly 500 heads and 500 tails. If, however, you toss it only a small number of times you may easily chance to get quite a big proportion of heads and small number of tails. The point to be emphasised is that the machinery of heredity works in a precise and mathematical manner. Where we know enough about the mode of inheritance in a character, we can predict the odds concerning the appearance of that character in the progeny.

Another Type of Inheritance.—An example of another type of inheritance can be found in the case of mating a White Shorthorn to a Black Galloway. The progeny of this cross will be all blue-grey. If you mate two of these first crosses together, then you will get calves that are black, red, blue-grey, roan. and white. Again, the colours appear in definite numerical proportions. The blue-greys will be the commonest, and next will come black and whites, followed by roan, while the reds will be comparatively rare. Incidentally, the majority of the whites will have black ears, but the odd one in sixteen will have red ears. We can predict the odds with which any of these colours will turn up.

So much for a character conditioned practically entirely by heredity. Unfortunately for the genetic—or hereditary—analysis of the problem, the majority of the productive characters of our livestock are conditioned both by heredity and environment. Let us take milk yield in cattle as an example. Before we can start to study the inheritance of milk yield, or to assess the inherent milking capacity of individual cows, there are many points which we must take into consideration. There is the age of the cow, the age at first calving, the month of calving, the interval between calving and service, and the length of the dry period. There are, besides, a lot of other points relating to the nutrition of the animal and the type of husbandry under which it is kept. Obviously, we cannot expect as good records on a farm a thousand feet above sea level, where very few concentrates are fed to the cows. Nevertheless, the animals reared on such a farm may possess as good an inheritance for the production of milk as higher yielding cows reared on lush lowland pasture.

Milk Inheritance.—How is milk inherited? If I could answer that question precisely and accurately, I would be able to make my fortune. Unfortunately, owing, as I have said, to the interactions of environment upon hereditary characteristics, we cannot be definite about the mode of inheritance of milking capacity, and it is unlikely for many years that we shall achieve this happy position. Nevertheless, a considerable volume of work has been accomplished in all parts of the world, but particularly on the Continent of Europe and in North America, which has laid open certain quite definite facts, and also points to other knowledge which, if not quite so definite, may be fairly helpful.

I do not propose to give you the tribulation of understanding the highly complex methods by which many of these research workers have set about their investigations. It is my intention to give you the results of their work, and, in anything that I say concerning the hereditary character of milk yield I would be grateful if you

would remember that even the best of inheritance can be masked by a bad environment, and that this fact, doubtless, accounts for many of the anomalous results which breeders may experience.

In the first place, total yield of milk is inherited quite independently of total yield of butter fat. Further, the total yield of milk which a cow may give is far more affected by environmental causes than is the total yield of fat. This leads to the apparently anomalous fact that when a cow goes off her milk there is usually a tendency for the percentage of fat to rise. This does not mean that the cow is secreting any more fat. She is probably secreting about the same amount of fat, but since there is a lesser quantity of milk, the percentage of it in the milk is increased. This also accounts for the fact that when you try to select for high-yielding cows alone and ignore the question of butter fat, you obtain animals which, while they are high yielders, give only a small percentage of fat. Actually, the fat that they give, when measured in pounds, is probably about the same as their ancestors gave.

Mineral Content of Milk.—As regards the other constituents of the milk, many of these are almost entirely conditioned by heredity and very little influenced by nutrition. Take, for instance, the mineral content of milk. With the one exception of iodine, it does not apparently matter how much minerals you put into the feed, they have very little effect upon the amount secreted in the milk. You must not, however, imagine that for this reason you can ignore the feeding of minerals to dairy cows. On the contrary, it is most important that you should do so for their good health. Similarly, the size of the butter fat globule is largely conditioned by heredity, but what is more important, especially to Ayrshire breeders, is the hardness of the curd of the milk. The softer the curd may be the more easily is the milk digested by infants and invalids. All investigations which have been made clearly show that the hereditary influence is most potent in this respect.

The colour of milk is the product both of environment and heredity. No amount of feeding can make an Ayrshire give milk the colour of that secreted by one of the Channel Island breeds. Suitable feeding may make it approach that colour, but with similar feeding, a cow of the Channel Island breeds would give a much yellower fat. There is considerable variation in the amount of the vitamins secreted in milk, but this appears to be in no way conditioned by inheritance.

Some Interesting Results.—Coming now to the inheritance of the total yield of milk, as I said before, I will not weary you with all the details, but will endeavour to give you some of the results. The most useful way in which the subject might be approached is to deal with the selection of a dairy beast. First of all, let us consider the purchase of a mature cow. In this case you have the definite records of the cow to go upon. For a constructive breeder to buy a dairy cow without knowing how much milk she is capable of giving is, to put it mildly, rather foolish. Undoubtedly conformation is an indication of the amount of milk which she can give, but it is not a reliable indication. The chief value of conformation is to be able to judge the general health of the cow and ability to live a long life.

As regards heifers, there is nothing in their conformation which can be taken as an indication of their milk-producing capacity. We are thus thrown back upon the pedigree. Pedigree, in conjunction with milk records, is of undoubted value. The parents are of primary importance. Of the two grand dams in the pedigree particular emphasis should be laid upon the productive qualities of the dam of the sire. To have wonderful producing great-grandparents, while the grandparents and parents are only mediocre is of no value whatsoever.

Then comes the bull. Most people like to bet on a certainty. The only thing approaching a certainty in the selection of a dairy bull is a proven sire, where his inherited qualities may be judged by the productivity of his daughters. A bull who has left his daughters giving milk above the average, and also more milk than their dams is indeed a valuable animal. This is really the best guide to the purchase of heifers, that they should be sired by a bull that has proved himself good. In the selection of a young bull particular attention should be paid to the milk-production of his dam.

The great thing to remember about the inheritance of productive qualities in our livestock is that animals inherit potentialities and not completed structures.

Tanning of Hides—The Chrome Leather Process.

In an issue of these notes of some months ago, details as to how to make white hide were published. While white hide is a useful leather for general repair work around about the farm, the making of chrome-coloured leather from horse or cow hide is a subject of frequent inquiry. In supplying this information, the

Lecturer-in-charge of the Sydney Technical College Tanning School points out that the average farmer may find himself at a disadvantage in following out the process owing to lack of plant and experience. The procedure is as follows:—

1. Soak and wash the hide immediately after it is removed from the carcase. Time for this operation, four hours.

If the hide has been salted, wash well and leave in water overnight. The best tanners find it difficult to obtain good results with dry hides, and the farmer should therefore avoid them if possible. If not possible, then wash and soak them, using plenty of clean water until they are soft. The time taken varies from two to three days.

2. Remove the hair by soaking the drained hides in milk of lime, using 30 lb. of lime to 100 gallons of water.

Handle each day and leave until the hair can be removed—about six to seven days in summer. If sodium sulphide is available, use 1 to 3 lb. per 100 gallons of lime liquor; this addition will reduce the time for unhairing to four days. The hair is scraped off with a clear-edged, not not sharp, knife.

3. Remove all flesh and fat by scraping with a knife. Wash well with several lots of water during the twenty-four hours after removing the hair and flesh.

4. Soak 1 lb. of bran for each hide in 4 gallons of water for twenty-four hours, and then use it as an extra wash for the hides. This will take four hours.

5. Make up a chrome liquor as follows:—6 lb. sodium bichromate, 6 lb. sulphuric acid, 2 lb. sugar.

Dissolve the sodium bichromate in 2 gallons of water, then add the sulphuric acid, and finally the sugar in small proportions. When the sugar is added the solution will boil furiously. If all the sugar is added at once the solution will boil over, but it should be kept boiling by the slow addition of sugar until the colour of the liquor changes from yellow to blue.

The above chrome stock liquor will tan 150 lb. of wet hide from the bran wash.

6. Add the chrome liquor to the tanning bath in three lots at intervals of one day. Use enough water to cover the hides and allow 3 lb. of salt for every 10 gallons of water; then place the hides in the salt liquors before adding the first portion of the chrome liquor.

Allow six days for complete tannage, when a cut section should show that the blue chrome salt has pentrated into the centre of the hide.

7. Neutralise by washing in water and then in a bath containing 1½ lb. of sodium bicarbonate for 150 lb. of wet hide. Time taken—16 hours.

8. The hides are now washed and should receive a coat of neatsfoot oil on both sides.

9. Hang up the wet, oiled hides to dry.

10. When dry, stretch until soft. If dry hides are difficult to stretch, sprinkle with water and cover for two days, and again stretch and dry. The hides will remain soft if enough oil is used.

Handling is very important when hides are in the above solutions. To do this work properly, the hides should be removed from the solutions two or three times a day for about five minutes each time.

The hides are generally cut up the back, giving what is known as two sides. This is generally done before removing the hair.

Chrome leather should be suitable for repairs, &c., about a farm.—A. and P. Notes, N.S.W. Dept. Agric.

Why Cream is Second Grade.

Of the various causes of second-grade and "border-line" cream there is none so common as the contamination resulting from inefficient washing of dairy utensils. Contamination may result from—

Failing to wash up twice daily.

Washing up with cold water, either once or twice per day.

Leaving the separator unwashed at night.

Failing to use washing soda to remove grease from utensils.

Using objectionable cloths or unclean brushes for washing up.

Failing to scald thoroughly all utensils, brushes, &c., after washing.

Failing to wash and scald cans on their return from the factory.

Washing up utensils in polluted water—rain water is always preferable.

Hand-reared Pigs.

Mr. A. G. Stewart, proprietor of Strathmore Stud Piggery, Cedar Pocket, near Gympie, recently had the misfortune of having his Large White sow contract mammitis when her litter was born. Mrs. Stewart took an interest in the young pigs, and her experience in rearing the litter should be of interest to pig-raisers.

On the day following the birth of the litter of twelve pigs the sow was found to have completely lost her milk flow, and through her sickness the sow had killed two of the litter. When the remaining ten pigs were two and a-half days old and almost dead from starvation they were taken in hand and fed from a dish a mixture of half whole cow's milk and half water every two hours daily and once through the night. In the meantime Mrs. Stewart sought advice on the feeding, and then altered the diet to half separated milk and half whole milk, with sugar to sweeten. This was when the pigs were four days old.

During the third week the pigs were put on to one and a-half-hourly feeds during the day and one during the night. This was continued until the sixth week, when they were reduced to six feeds daily.

The food was kept half whole milk and half separated milk till the fourth week, when the proportion of separated milk was increased, and by the eighth week they were getting two parts separated milk and one part whole. During the sixth week whole maize grain was given in a hopper, and the pigs made good use of it.

The pigs were allowed to run on grass most of the time, and when they were deprived of this during the seventh week they got diarrhœa and lost their appetites. However, this was remedied by giving access to the grass run and a dose of castor oil to each pig on two consecutive days.

End of 1st week..	10 pigs weighed	42 lb.—Average weight,	4.2 lb.
End of 2nd week..	10 pigs weighed	80 lb.—Average weight,	8.0 lb.
End of 3rd week..	10 pigs weighed	142 lb.—Average weight,	14.2 lb.
End of 4th week..	10 pigs weighed	200 lb.—Average weight,	20.0 lb.
End of 5th week..	*9 pigs weighed	240 lb.—Average weight,	26.6 lb.
End of 6th week..	9 pigs weighed	333 lb.—Average weight,	37.0 lb.
End of 7th week..	9 pigs weighed	396 lb.—Average weight,	44.0 lb.
End of 8th week..	9 pigs weighed	459 lb.—Average weight,	51.0 lb.

* One pig died from sorghum poisoning.

The rearing of this litter of pigs is considered a very satisfactory achievement, as very few litters reared by the sow have an average weight of 40 lb. at eight weeks old.—E. J. SHELTON, Senior Instructor in Pig Raising.

Hints on Soldering.

The materials necessary for soldering are one or two soldering irons, some sticks of solder, a bottle of muriatic acid (spirits of salts), and a small block of sal ammoniac. A handy container for the fire in which to heat the irons can be made out of an empty benzine tin or oil drum by cutting out the top, punching a few holes in the bottom, and cutting a hole in the side within an inch or so of the bottom, so that the heads of the irons can be passed through into the fire.

To prepare to solder, pour into a bowl (glass or ware—not tin or galvanised-iron) a quantity of the spirits and add a few pieces of zinc to "kill" the liquid. The soldering iron is first heated to a dull red heat, a fair portion of the point is filed clean, and this portion (while the iron is still hot) is rubbed with the sal ammoniac. The clean point is then tinned—that is, coated with solder—and this is of great importance if good work is to be performed later. To tin the iron, run a little solder on to a piece of clean tin, alternately turning its point in the melted solder and dipping it in the killed spirits.

Before using the soldering iron, clean the joint to be soldered, and with the aid of a brush put on a little of the killed spirits. The iron should be hot enough to make the solder run freely, but do not let it get red-hot. Withdraw it from the fire, brush the point with a piece of bagging, and dip it in the prepared spirits; then place the point of the iron on the joint to be soldered and move it slowly along, supplying solder as required by placing the end of the solder stick against the iron near the point. When soldering a loose patch, it will be found convenient to run a drop of solder on to the joint first, then hold the patch firm with the aid of the solder stick while the iron is operated to make the patch firm. The edges of any joints to be soldered should be fitted neatly and closely together, and the solder should run freely and adhere almost as if it were part of the tin.

Scours in Calves—Often Due to Parasitic Worms.

The occurrence of sickness and death among calves accompanied by loss of condition, scouring, and the development of "bottling" under the jaw, should lead to the suspicion that the stock are infested with parasitic worms, and a post-mortem examination of a very sick calf should be made to confirm the diagnosis. Some of the larger worms, such as the wire worm of the stomach, are readily seen, but the smaller parasites are difficult to demonstrate in an examination made in the field. Sometimes, by smearing a little of the stomach content, or the content of the first few feet of the small bowel, on a piece of clean glass or on the hand, the tiny worms will be discovered, but even when the worms are present the owner may not recognise them as parasites. In the case of doubt, skilled assistance should be sought.

Treatment and Prevention.—All the animals in the infested herd should be treated with a reliable remedy, after starving for twenty-four hours. A number of preparations will give good results, but the bluestone and mustard drench is cheap and very satisfactory. This is made up as follows:—

Bluestone crystals (copper sulphate)—8 oz.
Mustard—8 oz.
Water—3 gallons.

The bluestone should be dissolved in the water in an enamel or wooden receptacle. (Do not use iron buckets or kerosene tins.) The mustard is mixed to a smooth paste and then stirred into the bluestone solution. The mixture must be kept stirred, since the mustard will tend to sink to the bottom. The doses are as follows:—

Calf aged 4 months—3 oz.
Calf aged 6 months—4 oz.
Calf aged 9 months—6 oz.
Calf aged 12 months—8 oz.

Necessity for Repeated Treatment.—One treatment will produce some good effect, but it will be necessary to repeat the dosing in a fortnight, and again in a month, to obtain the best results. Where the infestation is heavy, and the stock are constantly reinfesting themselves from the eggs scattered over the pastures, drenching at regular intervals right through the year may be necessary.

If stock have become very low in condition, many may eventually die in spite of the treatment. This is because, although most of the worms have been killed by the medicament, the animals have lost so much vitality that their bodies are unable to build up and restore the tissues damaged as a result of the invasion by the worms. Hence when a diagnosis of worm infestation has been made, it is essential that treatment should be carried out as early as possible.

General Management.—A week after the cattle have been drenched they should, if possible, be removed to other paddocks, so that they will not be as likely to re-infest themselves. The infested paddocks used by the calves might be grazed by adult cattle, these not being so susceptible to the attack of worms. Most of the parasites which infest stock require moisture for their development on the pastures. Hence, low-lying areas which are constantly damp, swampy patches and soakages, are dangerous in that they provide conditions suitable to the hatching of the eggs and the later development of the embryo worms. In districts where worm infestation occurs the young stock should be grazed as far as possible on well-drained paddocks.

Frequently the ill-effects of worm infestation is most marked in the winter months, when the pasturage is known to be innutritious, and the calves should then be given a daily ration to make up for this lack of nutriment.—A. and P. Notes, N.S.W. Dept. Agric.

Points for Pig Raisers.

Spring pigs are those born during the spring and early summer months of the year. They invariably do well and have a better opportunity with more favourable food supply and better weather than those often spoken of as autumn pigs, which are born ahead of the cooler months of the year when food supplies are on the down grade and lower temperatures prevail. This does not infer that pigs do not develop satisfactorily during cold weather, for some of the best pigs in the world are those produced under harsh conditions in cold countries like Denmark, Sweden, Poland, Lithuania, and other European provinces.

Sunshine, fresh air, and plenty of nutritious foods are much to be desired in the breeding and feeding of stock for profit.

Overseas publications use the term "gilt" and "yelt" quite a lot in discussing pigs. These terms mean the same and apply to the female pig dating from weaning up till the time she produces her first litter. After that the gilt or yelt become fully fledged matrons in the herd and are known as brood sows, breeders, or as sows. The term "hog" invariably applies in this country to the entire male pig used for breeding purposes. The castrated male is known as a "barrow" pig. In America and other countries the term "hog" is used to describe all pigs irrespective of sex. The term "swine" is synonomous with pig—in fact, it is desirable to eliminate the term swine altogether and to use pig in discussing this class of stock and pig industry affairs associated with breeding, feeding, marketing, &c.

In-breeding, or the mating of animals which are too closely related is not advised in the breeding of pigs, as it invariably predisposes to weakness, barrenness, or sterility, and makes the animals more susceptible to diseases like tuberculosis, pneumonia, rickets, &c.

Line-breeding is a system of breeding practised for a special purpose and is a scientific business that should not be attempted by the inexperienced farmer. It is better to use males and females entirely unrelated than to run the risks associated with in-and-in-breeding or neglected breeding generally.

Pigs should not be weaned before they are eight weeks old—i.e., unless the sow suckling them is unable to do her job properly and has an insufficient supply of milk. It is preferable to allow the pigs to suckle the sow till nine or ten weeks of age than to wean before eight weeks, and the males that are to be castrated should be operated on between the age of five and six weeks. This operation should not be deferred till after weaning, as it becomes more risky and more difficult to perform as the animal develops and there is greater loss of time in recovery to normal health again.

When selecting a sow for breeding purposes be careful to make close inspection and see that the selected animal has no fewer than twelve teats. The sow with ten teats might be just as good a breeder or she might not, but it is better to be on the safe side and make twelve to fourteen teats a requirement in selection. In fact, if sows with sixteen teats are available, select them also, provided they are otherwise suitable, for the more young pigs a sow can suckle and rear to weaning age the better it is for the farmer, and unless the sow has the teats she cannot suckle her pigs. The sucking pig usually keeps to the same teat, and if the number of pigs is in excess of the number of good teats the balance of the suckers should be transferred to another sow or be bottle-fed or be destroyed, as it is useless expecting good results if the pigs are unable to suckle together without undue fighting or robbing. Small weakly "runts" rarely pay for keeping, and they often spoil a good litter and irritate a good sow, causing more harm than they are worth.—E. J. Shelton, Senior Instructor in Pig Raising.

A Point in Horse Training.

In farm or road work the fast, even walking horse covers more miles in a day than one of erratic gait. It is not only a pleasure to sit behind a fast walker but saves time. In these days of high costs in every direction, the fast walker, by doing more work in a given time and costing no more to feed or drive is the more profitable animal to keep. The conformation of many horses is such that all the teaching and patience in the world cannot make them walk fast. Nevertheless the walking pace of every horse can be fully developed by careful training.

The treatment the young horse receives when being broken in often spoils the paces. It takes more time and patience to develop a good walking pace than many people are prepared to devote to it. The conformation of some animals is such that they require little teaching. The great fault is that so many men when breaking in a horse urge it too much in the early stages and expect it to go at a regular level pace too soon, with the result that its full measure of pace is never attained.

Too much attention cannot be given to training the young horse to walk well, for it is the foundation of its usefulness. How often has many a splendid goer disappointed his owner the first time he got into heavy pulling by virtually jibbing because he had never been taught to walk in a vehicle. The farm horse's work is done at a walking pace.

Apart from training much can be done towards the improvement by breeding only from mares that walk naturally and putting them to stallions of the right conformation that also walk freely.

Buying Better Boars.

That Queensland farmers have fully appreciated the advantages offered under the Pig Improvement (Better Boar Subsidy) Scheme is evidenced by the success that has attended the scheme initiated towards the end of last year by the Hon. the Minister for Agriculture and Stock (Mr. F. W. Bulcock), under which, on approved boar purchases, a 50 per cent. subsidy refund has been paid to purchasers of Large White and Middle White boars four months old and over, provided the maximum subsidy did not amount to more than £5 5s. The scheme is still in operation, but all future purchases will have to be arranged through the Rural Industries Board of the Agricultural Bank on a basis of the loan of 50 per cent. of the purchase price, repayable over two years.

Under the new conditions Berkshire and Tamworth boars will be included in the scheme as well as Large and Middle Whites, the age of approved boars being between four months and two years.

Full particulars of this scheme may be now obtained, and pig raisers are urged to act immediately if they desire to benefit under this system of purchase. It is of interest to notice that under the subsidy refund scheme Large White and Middle White boars have been distributed over a wide area of the State, including the following districts:—

WESTERN.—Dalby, Komine, Walloon, Square Top, Surat, Warwick, Aubigny, Cushnie, Pinelands, Drillham, Yamsion, South Canning Downs, Miles, Jondaryan, Kiamba, Mitchell, Kupunn, Moore.

MORETON.—Ipswich, Rosevale, Gold Creek, Marburg, Bundamba, Pine Mountain, Minden, Purga, Calvert, Biarra, Fernvale.

SOUTH BURNETT.—Tingoora, Murgon, Wondai, Cinnibar, Goomeri, Nanango, Cushnie, Wooroolin, Maleny, Kiamba, Mundubbera, Tableland, Brigooda, Boonenne, Manumbar, Gueena.

UPPER BURNETT.—Abercorn, Berajondo, Gayndah, Cannindah, Riverleigh, Biloela, Littlemore, Thangool, Kalaldo.

NORTH COAST.—Bauple, Howard, Builyan, Eerwah Vale, Widgie, Palmwoods, Maleny, Imbi, Mapleton, Kilcoy, Samsonvale, North Arm, Eumundi, Gunalda, Rockhampton, Garden Island, Mount Kilcoy, Mooloolah, Kin Kin, Redcliffe, Lagoon Pocket, Cooroy, Caboolture, Peachester, Zillmere.

SOUTH COAST.—Rathdowney, Ormeau, Currumbin, Sprinbrook, West Burleigh, Beenleigh, Gleneagle, Maroon, Cotswold, Upper Coomera, Hillview, Lindum, Jimboomba.

NORTHERN.—Innisfail, Bambaroo, Ingham, Malanda, Delta, Millaa Millaa, Manton, Peeramon.

Practically the whole of the animals selected were bred in this State, thus reducing transit expenses and giving additional encouragement to Queensland breeders of the type required.

It is pleasing to know that the stimulus thus given to the purchase of better boars has resulted in a widespread demand for boars in the two other principal breeds not previously included in the scheme, but now provided for by the Rural Assistance Board's Scheme.

At no previous period in the history of the stud pig breeding business has there been such excellent demand and sales, although the range of values has been lower than for three or four years past when pig prices generally were higher. In fact, the position has improved to such an extent that several breeders report having sold all the available stud animals, and orders have been placed by them covering the purchase of additional breeding stock.

Breeders of Tamworths and Berkshires have also benefited to an extent not previously anticipated, and prospects for the future are bright.

Application forms and all information in connection with the new scheme may be obtained from the Rural Assistance Board, Agricultural Bank, Brisbane, or through the Department of Agriculture and Stock.

"Choicest" should be only Grade of Dairy Product.

There should be only one grade of dairy product—namely, "choicest"—and the attainment of this ideal depended largely on cleanliness and good management on the farm. That was the kernel of an address by Mr. J. B. Timbs, manager of Bowthorne Butter Factory, at the recent Hunter River and Lower North Coast Conference of the Agricultural Bureau of New South Wales. In many cases, continued Mr. Timbs, the fault for products being graded lower was with the farmer, and the result was a loss to the industry.

While it was necessary for the farmer to have a good herd to obtain choicest dairy produce, there were many matters connected with the management and treatment of the animals which also had considerable influence on quality. Any cause of over-heating, for example, detracted from the value of the milk. A cow bulling, a cow chased by dogs, or one brought quickly from a lucerne paddock to avoid "bloat," might cause 50 gallons of milk to be put out when the "blue test" was applied.

Milk that was really clean could be kept for days—and even months—but as the result of the action of bacteria the quality was lowered. These organisms entered milk from the atmosphere and from dirty surroundings. In winter they did not develop as rapidly as in summer, for a temperature of over 50 degrees was more favourable for their increase. One bacteria might divide into two in twenty minutes, four in forty minutes, and each of this rapidly increasing number had to be fed on the sugars in the milk. If dirty conditions obtained anywhere in the dairy there would be millions of bacteria to start with, and after four or five hours on the road the milk would be thrown out when it reached the factory. Dusty yards were a prolific source of bacteria.

One of the things necessary to ensure that milk was kept clean was that the water used for washing the hands when milking must be clean. On the average farm the same water was used many times—sometimes as many as fifty if that number of cows was milked. The problem of the convenient supply of clean water for this purpose was a real one on many farms, but Mr. Timbs suggested hanging a 4 or 5 gallon container fitted with a brass tap between each two bails—a milk can past use for milk would do—and filling these before milking so that a supply of clean running water would be available for rinsing, not only the hands, but also the cloths used to wipe the udders after each cow. The careful wiping of each cow's udder was essential, for the udder was a very definite source of bacterial infection.

Many dairy farmers who washed their hands with care and who were particular as to the condition of the udders and even the cloths used to wipe them, failed to realise that contact of their hands with the milking stool—which probably had not been washed in its lifetime—could be the cause of millions of bacteria entering the bucket, while the handling of the bail release stick was another prolific source of bacterial infection.

It was necessary, also, that cracks in the floor of the bails be repaired, otherwise there would be accumulations of urine and milk which it would be impossible to clean. Repair work consisted of excavating the crack and filling with a cement grout.

An efficient system of cleansing dairy utensils in the milk room was a necessity The proper system was cold water, hot water and "elbow grease," and then *boiling* water. The most usual fault in regard to cleansing was that the water was boiled elsewhere than at the dairy, while a common practice was to pour the water from one can to the other till it was often quite cool. The best method was to pour, say, ½ gallon of boiling water into each, put the lid on for a few minutes, and then stand them on an iron bench inside the milk room. Wooden benches became impregnated with bacteria.

Time to Plant Trees—Their Value on the Farm.

Though their claims are so generally neglected, trees serve many important purposes in farming and pastoral areas. They may be usefully employed in the following ways:—

As windbreaks and shelter belts.

As isolated or scattered shade or shelter trees.

As a reserve supply of fodder for periods of drought.

As tree plantations to supply the timber and fuel requirements of the farm, in addition to providing a source of revenue by the sale of products.

As screens around dams and tanks to prevent silting up by dust and undue evaporation of the water contents.

As a means of preventing erosion on slopes and along the banks of creeks and rivers.

As a means of enriching worn-out or poor land.

As ornamental trees in improving the appearance of the homestead.

As bee trees.

Generally speaking, May to August are the best months for tree-planting.

Berkshire Pigs—Evolution Traced—Special Characteristics.

Trace back the history of the Berkshire and you will find that this breed has been recognised as distinct for more than a century. It is probably that, as well as the fact that these pigs have been consistently developed for their commercial characteristics, which accounts for their wonderful record.

"The Grazier," dated 1808, published a brief article on the breed, and also a print of two Berkshires exhibited at a cattle show in 1807. During the first half of the eighteenth century their principal home was among the small woods on the downs in the west of Berkshire. From there they were taken in droves by road to Oxford, Reading, and other markets. The first exportation of Berkshires was in 1825, when a settler took several head to the United States.

About the middle of the last century the colour of the breed was black and white, with a preponderance of the former. The origin of the present black body and white extremities was a friendly rivalry between breeders who attempted to get rid of the white hair on the body. Their efforts met with such success that, as early as 1856, a first-prize pen was described as: "Colour mostly black, with white legs and tails, and a few splashes of white about the body."

By 1869 the markings as we know them to-day were general in the best herds, except that small patches of white hair were allowed on the lower parts of the shoulder. In 1847 the shape of the snout was moderately dished, long, and fairly pointed. The first pedigree record for Berkshires is dated 1859, while the first volume of the Herd Book was issued in 1885 from a collection of records made by Mr. Heber Humfrey (1859-1904), one of the most prominent of pioneers, breeders, exhibitors, and judges of that day.

In the specification of the breed it is stated that the general character of the animal should indicate type, quality, and breeding. Boars should have a masculine appearance, sows a feminine one. The head should be moderately short, the face dished, and the snout broad. Width between the eyes and ears is desirable. Ears should be fairly large, carried erect or slightly inclined forward, and fringed with fine hair. The jowl ought to be light.

A good neck is fine, evenly set on shoulders, and free from wrinkles. Shoulder blades, too, should be fine and well sloping. Special attention is given to this characteristic in females. The legs should be short, straight, and strong, set wide apart, and standing well on toes. The animal should walk well. The back should be long and level, with the tail set high. Sides should be long and deep, the ribs well sprung. Broad hams, wide and deep to the hocks are desirable.

The belly should be thick with a straight underline. Depth through the heart is required. Both males and females should possess well-developed bone. The flesh should be firm without excessive fat, the skin fine and free from wrinkles, and the hair long, fine, and plentiful. Manes are undesirable, particularly in females. The colour should be black, with white on the face, feet, and tip of the tail. A crooked jaw and a rose back are both regarded as definite imperfections.—"The Weekly Times."

Paper Mulch for Pineapples.

From time to time encouraging reports concerning the use of paper mulches in horticulture have been received from overseas. In Hawaii the practice has become an important one in commercial pineapple growing. In 1930 Sydney firms handling lines of special mulch papers from America made available to the Department of Agriculture supplies for experimental purposes, and during the last three years trials with pineapples have been carried out at Grafton Experiment Farm.

A report of these trials in the current "Agricultural Gazette" of New South Wales summarises the results as follows:—

(1) A paper mulch in a dry season greatly aids in keeping the soil moist and in good condition, and enables the plant to make fuller use of the richer top layer of soil.

(2) Paper mulched plants flower and mature their fruit two to three weeks earlier than those receiving ordinary cultivation.

(3) The paper-mulched plants are more productive, and their fruits larger and of better quality.

(4) Paper mulching effects a considerable saving of time in cultivation. only occasional hand-weeding being necessary as opposed to frequent cultivation in the case of plants unmulched.

(5) With careful use the paper mulch should last several seasons; in the case of annual crops it is rolled up and put away at the end of each season.

The Meat Export Industry.

In an address on "The Past, Present, and Future of Australia's Meat Export Industry," at a recent meeting of the Hawkesbury Agricultural College Branch of the Agricultural Bureau of New South Wales, Mr. J. B. Cramsie, ex-chairman of the Meat Industry Board, said most old cattle men thought our cattle were the world's best, and this was the stumbling-block to Australia's meat export trade. Our cattle were not in any way the best, and, in fact, generally had depreciated since the war. This was mainly due to the use of the scrub bull and to deterioration in our grass lands. After travelling in every meat-producing country in the world, and thirty-five years in the industry, however, he was sure Australia could produce as good a quality meat as any other country, and more cheaply.

Australia exported only frozen meat, and her freezing works were the best in the world, but it must be definitely understood that these plants were not in any way suited for chilling beef. In the chilling of beef we had lagged behind Argentine, New Zealand, and other countries. Australia should follow Argentine and Uruguay, who forty years ago were producing as rough a type of cattle as was possible. By buying the best English bulls, however, Argentine now produced excellent meat, which was readily sold in Great Britain. Uruguay had proved the value of pasture improvement. That country was only half the size of Victoria, and yet it owned 9,000,000 cattle and 20,000,000 sheep. The best exotic grasses were introduced, and Uruguay now produced the best baby beef.

The scrub bull was a greater curse in Australia than the rabbit or prickly-pear, for it was through the use of scrub animals that Australia's beef had deteriorated so much. Of the bulls in use, 75 per cent. should be destroyed. He was a strong advocate of a "Scrub Bull Act." Argentine to-day had few bulls worth less than £40 per head, and it was because of these that her beef was so much sought after.

In regard to the Northern Territory, Mr. Cramsie said there was not one station there which had paddocks to put young growing females in. Consequently, the animals were bred too early, being thus ruined, and the steers produced were poor. Thus little hope was entertained for the Territory as an export meat producer.

Australia had had too many natural favours, and we had not learnt better methods from adversity. We stored little fodder, and failed to improve our pastures, so that when droughts occurred stock losses were enormous. New South Wales, for instance, had lost over 75,000,000 sheep from these causes, and in one drought (in 1919-20) 10,500,000 sheep perished.

If Australia was to enter the fat lamb trade successfully, then she must (1) improve pastures; (2) select only the best ewes; (3) use the best ram that money could buy. In regard to the ewes, there was no need to interfere with the wool side, and Australia's name for wool could be maintained while making a market for fat lambs. The use of a good sire was very important, as often he was responsible for 75 per cent. of the characteristics in the progeny. The motto for fat lamb producers should be "Breed the best and feed the best."

Australia must follow the agrostologist more closely to-day. With proper improvement and management of pastures we could carry three times our present number of cattle.

He was definitely in favour of country killing when properly organised. Individual centres could not hope to be successful with country killing, as there would be much opposition from vested interests, and they could not arrange for shipment successfully. There was no reason why sheep and cattle for meat export should be brought to Sydney for slaughter. This resulted in 1s. for loss in weight and quality of carcass, and 1s. in extra freight per sheep. Werris Creek could be made a country killing centre for the northern part of the State, Orange for the central part, and Cootamundra for the southern part. A great deal of organisation would be necessary to arrange for cold stores, shipping facilities, and marketing.

The only solution to the beef industry, said the speaker in conclusion, was the chilling of meat. Only a relatively low percentage of the cattle slaughtered, however, was suitable for chilled beef.

Turning Wheat into Wool.

In an address at the recent South-Western District Conference of the Agricultural Bureau of New South Wales, Mr. D. Kelly, of Quandialla, advocated placing 100 acres of a 200-acre holding under wheat, and for comparative purposes growing hay and running sheep on the other half. Costs were considered and figures quoted to show that the net return would be much greater from the area running 1,000 sheep as against the equal area on which wheat was grown. The figures given were:—

Wheat—

100 acres sown; 14 bus. crop (district average) at 2s. 10d. bus. = £200.

Hay and Sheep—

100 acres sown; $1\frac{1}{4}$ tons crop (district average) = 125 tons.

$1\frac{1}{4}$ tons hay at daily ration of 1 lb. chaff per sheep would feed 10 sheep for a year. 10 lb. wool per sheep at 1s. lb. = 10s. sheep.

Therefore 1,000 sheep would give return of £500.

Header and binder costs would nearly balance, and cutting and handling hay would equal carting wheat to rail.

The loss of sheep (say 5 per cent.) would equal £50, and shearing, say, £20.

Allowing for other incidental expenses, Mr. Kelly submitted that there ought to be a substantial balance in favour of the hay and sheep project; he intimated that it was his intention to try such an experiment next year on four times the scale referred to.

Points in Rearing Calves.

Always handle calves quietly and patiently.

Feed at regular times each day and in regular quantities.

Feed only clean sweet milk—the calf is not designed to assimilate any other. Add some constituent to replace the feed value of the cream removed from the milk, and lime-water to assist digestion. Milk should be pasteurised if possible, and on no account should the froth be given to calves.

Feed the milk at body temperature. Cold milk requires a great deal of the animal's energy to heat it up to a point at which digestion can take place.

Cleanse feeding buckets as carefully as you would all other dairy utensils.

Keep the yard and its surroundings free of manure and rubbish. Such material breeds flies, and flies are active carriers of disease.

Provide shade in summer, and shelter from winter wind and rain. It is cheaper to conserve animal energy in this manner than by the use of larger amounts of food.

Always pick up any pieces of rag, paper, twine, &c., found about the calf paddock—young calves, like other young animals, are not discriminating in their diet.

Provide a suitable lick consisting of salt and bonemeal.

Marketing the Citrus Crop.

Good fruit is worthy of careful marketing, and he is a short-sighted orchardist who for want of a little final trouble jeopardises the chance of good prices for the product to which his whole year's work has been devoted. The reminder is seasonable for the citrus grower, whose attention is directed to the following important points:—

Exercise extreme care in packing.

Place fruit carefully in picking bags.

Carefully transfer fruit from picking bag to box.

See that the box has no protruding nails or splinters.

Do not jolt the fruit over rough roads.

Grade carefully for size and quality.

See that the sizing machine is functioning properly.

Use a clean case.

Pack neatly and tightly, but do not squeeze or jam fruit into boxes.

Stack cases on sides.

Herd Testing—A Woman's Viewpoint.

"A Dairy Farmeress" writes (9th July, 1934):—

"I have yet to thank you for the record of last season's results of the testing of my small herd. In some ways the results were a surprise, though in others they simply bore out my own opinion of my cows. I liked the testing—it added the factor of intelligent interest to an otherwise distasteful task, and also it gave me the opportunity of saying, 'I told you so,' on three separate counts.

"I am sending in to-morrow to request the factory manager to forward the testing bottles to start the new season's testing—some of my cows have young calves now, when their last year's calves are only eleven months old. I want to get the full period in this year.

"In your letter of 20th April (34/182), you say, 'It is hard to realise why so comparatively few dairy farmers, &c. . . .' In one issue of the 'Agricultural Journal' the same wonder is expressed and the opinion put forward that, as the free testing scheme has been in operation for so long, farmers' apathy can hardly be due to ignorance. Well, I'd like to say that, as far as my experience goes, you are wrong. I, myself, though brought up on the land, have not long been a dairy farmeress in my own right, and, though I knew there was a scheme of some sort, and believed in testing in theory, I knew nothing of the details. My nextdoor neighbour, recently moved in, has been dairying for years and knew nothing of it, and my neighbour on another boundary was equally in the dark.

"Neither of these people take the 'Agricultural Journal,' and were amazed when I told them the slight expense they'd have to incur to get it.

"The reason for their apathy is not far to seek. They regard dairying merely as a sideline—something 'the wife and kids' can fill up time with, something they themselves give a hand with when they have nothing more congenial to do. The real interest of these men lies in beef cattle. They do not as a rule buy real dairy stock. They just milk the best they can get out of their herds. The overburdened wife can be forgiven for not testing. It takes up time she ought to be spending darning the socks; and the children, poor little things, loathe milking like poison.

"Other men think they can pick a milker on appearances. One old fellow told me seriously the other day that 'the longer a cow's horns, the more milk she will give,' and also that 'you never find a tough cow a bad one'—a piece of fatalism that 'gave me to laugh,' for I was milking the toughest brute in our yard, and last season Babcock placed her at the bottom of the list. So you see?

"Last year my herd at no time numbered more than fifteen. I have fourteen in now, ten of them going on test now. By Christmas I expect to be doing between forty and sixty, and I want to test all but the obviously useless.

"I am very glad to have the facilities for testing that the Department of Agriculture offers."

Kerosene Emulsion—Its Preparation and Use.

As a general spray for scale insects on citrus and deciduous fruit trees kerosene emulsion has been largely superseded by miscible white or red oil. It can still be recommended, however, for the control of thrips and for fowl tick, fowl mites, fleas, and other vermin, states a departmental leaflet. The formula is as follows:—

Hard soap, ½ lb.

Kerosene, 1 gallon.

Water, 1 gallon.

Cut up the soap and place it in 1 gallon of water and heat until dissolved. Remove from the fire and immediately stir in the kerosene and mix until thoroughly emulsified.

For the control of thrips, aphids, &c., add this stock solution to 18 gallons of soft water (1 pint stock to 9 pints water). For fowl tick, fowl mite, and fleas, the stock solution should be added to 8 gallons of water (2 pints stock to 8 pints water). The stock solution may be diluted at once with cold water, but if allowed to stand until cold it must either be reheated or else hot water must be used to dilute it.

As kerosene is injurious to rubber, a warm solution of soda should be passed through the hose after using.

Water-storing Trees—Nature's Living Reservoirs.

Our Australian aborigines have long known that certain species of native trees are natural reservoirs containing, in some instances, quite considerable quantities of water. In the arid inland districts, and during prolonged periods of drought, it is evident such knowledge must be of great value.

Many smaller plants, such as the pigface, cactus, and the ice-plant (common along the Balonne River) conserve a proportionately tremendous quantity of water; and succulent epiphytes like orchids are capable of flourishing luxuriantly on bare rock by their ability to absorb water from moist atmosphere. Though the water-holding capacity of species such as the bottle-trees and coolibah is well known, numerous numbers of the eucalyptus family, besides the coolibah, come under this category. The list includes various species of stringy-bark, the Grey ironbark (*E. paniculata*), the popular box (*E. populifolia*), also called "Bimbil," and shiny-leaved box, the Morrel (*E. oleosa*), and at least five species of the mallees. Of the latter, the yellow or water-mallee, is perhaps the best known. The western bloodwood (*E. terminalis*) I should also have mentioned. There are, in addition to all these, the desert oak (*Hakea Grevillea striata*) and the needle-bush (*H. leucoptera*). Of the Casuarina family, *C. Decaiseuana* is another example, and several kinds of acacia are also known which store up water in excess of the average amount. In South Queensland scrubs several members of the grape-vine family (Vitis) are quite notable, and probably *V. antarctica* and *V. hypoglauca* are the most common. When chopped into short lengths, these vines exude a surprising quantity of quite wholesome water.—P.J.B. in the "Sydney Morning Herald."

Control of Bracken Fern—Value of Kikuyu Grass.

Because of its smothering effect on all other plants in a pasture, Kikuyu grass has been found of considerable value in the control of bracken fern.

The fern country on which it is intended to grow Kikuyu should be ploughed and worked prior to planting in the spring, or if the soil be of an open, free nature the fern fronds should be cut in the early spring, burnt, and the grass roots hoed in. On large areas drills 3 feet apart should be struck out with a single furrow plough, the Kikuyu being dropped every 3 feet in the bottom of the drill, and covered with a light furrow, or by running a harrow along the drills in the direction in which they run. If the weather is at all favourable the Kikuyu grass makes headway as soon as, or before, the fern, and by winter there is only sufficient fern showing to protect the grass from frost. By the following spring a mat of grass has formed over the blank spaces, and the fern is gradually choked out.

This grass provides excellent quality feed, and although mainly a summer grower it withstands dry conditions better, remains greener for a longer period, and provides a greater bulk of feed during the winter months than does Paspalum. Kikuyu is particularly useful for planting on hillsides, as it binds the soil together, and thus prevents washing of the surface soil.

In very cold districts its growth period is limited to a few months of the year; consequently successful results can only be looked for in areas where the rainfall is fairly plentiful, and where a long warm growth period is possible.—A and P. Notes, N.S.W. Dept. Agriculture.

Animal Health Station Commended.

A North Coast correspondent writes (23rd June, 1934):—"Please accept my very best thanks for the help I have received from your station (Animal Health Station, Yeerongpilly). Some months ago I wrote to you regarding a cow with a bleeding lump in the ear. The cow was most distressed and could not chew the cud with comfort. In her irritation she would rub the ear, causing it to bleed most alarmingly. Your advice was to place spirit (rectified) in the ear and paint the lump with liquor Iodi. fort. 1-6. The result was most magical. Not only was there improvement from the first day, but after a few weeks the lump, which was as big as half a hen's egg, completely disappeared, and the cow calved normally, and is now milking well. For a cure like that one would willingly pay a good many "bull taxes." It is a great comfort to know that your body of experts at Yeerongpilly are working day and night for the benefit of us dairy farmers, and it can only be very ignorant people who object to paying a small contribution to help things along."

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

ILL-NOURISHED CHILDREN.

POORLY nourished children may be seen by the skilled observer wherever he goes, says the monthly article issued by the Queensland Baby Clinics for the guidance of those who have the welfare and care of young children. Fortunately they are usually fewer in number than the well-nourished children, but there are many of them.

Their number varies in different places and at different times, but they are always present. There are many causes of poor nutrition, but in all but a few the cause is simply defective diets. By this we do not mean that the children do not get enough food. They probably get as much as they will eat; they may even get expensive foods, but they do not get the right sort of food. Their mothers have never received a right education, and are not to be blamed for want of knowledge which no one has taught them. They are not to be blamed, but their children suffer all the same.

Want of Knowledge.

There is a widespread belief that the important foods are meat, white bread, butter, and sugar, and that all other foods are extras. Of the five necessary vitamins meat contains only one, white bread and sugar contain none, and butter, which is valuable for its vitamins, is expensive, and is being replaced by margarine. So long as times are good most people take a large variety of foods, and these often supply all that is needed in the diet. But when times are bad and thousands are on relief wages, it is only natural that mothers should concentrate on what they think the important foods. They satisfy their children's appetites with foods on which really good health is impossible. There is no starvation, but much bad feeding. Poverty is not the cause. The cause is want of knowledge, the evil effects of which are made more dangerous by want of money. The foods that are essential to children's health are only too often cut out because the mother thinks they are not important, and therefore she cannot afford to buy them. Meanwhile she spends money unnecessarily on foods of inferior value.

Milk is Necessary.

The most important of foods for children is milk, and this is often the first to be cut out. In some places poorly-nourished children have become very numerous. It is sad to see so many of the next generation being spoilt in the making—so many that will never grow strong men and women, but will help to fill our hospitals, when in later life they fall victims to all kinds of diseases—so many that will fall easy victims to tuberculosis, or become hopelessly crippled with chronic

rheumatism. The condition of their teeth will be such that all the dentists in Queensland working overtime, Sundays and holidays included, will not be able to do what is necessary. Every child under six should have a pint of good milk in some form or another daily. Every child over six should have at least half a pint, but a whole pint would be better. As it is, many families are given only a little condensed milk, or some powdered skimmed milk, in large quantites of water—a mere pretence of proper nourishment.

What can we propose for this great evil? Firstly, we must dispel this want of knowledge. Our Infant Welfare Service is responsible for all children under school age, and is doing its best to help their mothers. This work is difficult and slow, and we cannot reach mothers not within easy distance of our centres. A large number of new branch clinics are much needed. The next generation of mothers will, we hope, have been better educated before they leave school. Secondly, there are ways in which we can directly encourage the increased consumption of milk. These will be explained in our next article.

HONEY—A FOOD AND A MEDICINE.

Mr. H. Willoughby Lance, Apicu'turist, Department of Agriculture, West Australia, writing in the current "Journal of Agriculture," W.A., says, inter alia:—

THE human body requires a great variety of substances for its growth, maintenance, and development. The food required by growing children is much the same for all, but the food necessary for the maintenance and development of the adult may vary, according to the class of work engaged upon.

Certain classes of food are, however, required by humans of all ages, no matter what their occupation may be. One of the most important of these is the hydrocarbon group, and one of the commonest of this group is sugar. Sugar is commonly produced from the ground by growing vegetable matter. The commonest form of sugar known is that produced from the sugar-cane, and is to be found in practically every household in Australia. In European countries a large amount of household sugar is manufactured from the sugar beet. Both these sugars, however, are manufactured articles; that is to say, they are not in their natural state; they have been extracted from the cane or beet and gone through certain processes known as refining during which everything that is not plain sugar is removed.

The sugar contained in fruit and honey is just as Nature provides it and is in conjunction with certain acids and mineral salts which the body requires.

Chemically, there are three principal sugars contained in honey:—cane sugar (sucrose), grape sugar (dextrose), and fruit sugar (levulose), the last two together being called "invert sugar"—that in plain words mean that it has been inverted or changed. Cane sugar (sucrose) requires to be changed before it can be used by the human body; invert sugar has been changed and is ready for assimilation by the blood stream almost immediately it has been passed into the stomach. The sugar on our breakfast and tea tables is pure sucrose and must be acted upon by the secretions of the stomach and inverted before it can be passed into the blood stream.

Honey contains less than 2 per cent. of sucrose, and often practically none, and from 75 per cent. to 85 per cent. of invert sugar. It will thus be realised that the sugar in honey requires practically no effort to digest and the human body obtains the full benefit of the carbohydrate food. Carbohydrate foods are classed as fuel foods which supply the body with the energy needed for the various tasks it performs, rather than those whose function it is to build and repair the body. In addition to sugar, honey contains volatile oils which give it its aroma and flavour, and indicate to a large extent the plant from which it has been obtained; also a small amount of mineral matter, including magnesia, iron, calcium, phosphorous, &c. In this respect it differs from white household sugar, from which the mineral substances originally present in the plant juices have been removed by the refining process. Although the amount of these mineral substances in honey is not high, their presence must not be disregarded, as in many of the present-day foods they are entirely lacking.

As mentioned previously, honey contains both dextrose and levulose sugars, and it depends on the proportion of these and their relation to the percentage of water as to whether the honey granulates or crystallises solid, or only becomes thick, or whether a portion is solid and a portion liquid. The dextrose sugar granulates but the levulose does not. When the honey has a solid appearance all through, the levulose or fruit sugar fills in the spaces between the granules and is usually small in proportion; when part is granulated and part liquid, the levulose is greater in proportion.

Any honey that has granulated may be made liquid again by immersing the jar in water and raising it to a temperature not higher than 140 degrees F., that is to say, not hotter than one's hand can stand. The jar should not come in contact with the bottom of the vessel containing the hot water, but should stand on a piece of wood placed therein.

The value of honey is the same whether liquid or granulated—it is only a physical change that has taken place.

Another important value of honey is its inability to carry germs of any disease that attack the human frame, being self sterilising. The reason for this is that it is hygroscopic, that is to say, it attracts moisture to itself. All life contains water, even the smallest disease germ contains moisture, and if this is removed, it dies. Any germs, therefore, that may find their way into honey are destroyed by having their moisture taken from them by the honey. This is an important fact, which it is not belived applies to any other food.

Dr. Henry Lindlaker, in his Vegetarian Cookery Book, writes:—"Always the natural sugars should be used. Honey is the very best of all and should be given preference when available. Maple and pure cane syrup come next in order, then the brown unrefined cane or beet sugar. The highly refined inorganic sugars, powdered, and loaf sugars should not be used."

Sir Arbuthnot Lane, a physician on the staff of the Lady Margaret Hospital, London, in a booklet entitled "Honey for Health," says that "Honey is a food full of energy and therefore stands high as a producer of stamina and strength. Those who add honey to their daily diet may be assured that they are adding to their capacity to work with hands and brain. If every traveller would ask at his hotel for honey with his porridge or cereal foods, he would be far more fit to tackle the day's work. Honey has practically no waste matter in it. Extracted honey is one of the few foods that is all food, and is easily digested." He further goes on to say, "Where people are below par or depressed, where there is chronic constipation with absorbent poisoning, and in children's ailments, honey is a great panacea."

Another important use of honey is for cookery purposes in the place of sugar. In early days before the introduction of sugar, honey was practically the only method of sweetening known. In many countries to-day it is coming into its own for cooking purposes and is no longer a luxury. The twentieth century homemaker is dressing salads with honey, is flavouring tea fancies and cakes with honey, is baking ham for dinner with honey, and surprising evening guests with tasty honey nut sandwiches and delicious fancy cakes and biscuits made with honey.

In using honey for cooking it must be remembered that good honey contains about 17 per cent. water; therefore in mixing, less water will be required than with sugar; also that a cup of honey is heavier than one of sugar; that a cup of honey weighs 12 ounces and sugar 7 ounces, the weight of the sugar in the cup of honey being 9½ ounces as against 7 ounces in the cup of sugar.

One of the advantages of using honey in cakes is that they will keep moist for a very long period, and in fact are improved by keeping.

There are many kinds of honey in the shops, and a large number of people judge honey by its colour and perhaps mild flavour. This is a great mistake. Honey should not be judged by colour, but by its food value and flavour. The darker honeys have been proved by analysis to have a better food value generally than the lighter ones. Some of them certainly do not have an attractive flavour, but this can also be said of many of the light ones.

It is, however, largely a matter of use, and consumers are advised to accustom themselves to a medium coloured honey of heavy body. Thin honeys contain an excessive amount of water and are liable to ferment.

Summarised, the value of honey may be placed under six headings:—

It is the only natural sweetening substance on the market.

It has already been changed or digested by the bees, and is almost immediately passed into the blood stream.

It is an energy producing food.

It contains mineral and other substances, so necessary for the maintenance of health.

It cannot carry disease harmful to human beings.

It is pleasant and attractive to the taste.

The value of the regular use of honey as an article of daily diet cannot be over-estimated. In addition to this it has an important value as a medicine. Doctors in Europe and America now recognise this, and use it in their regular practice. It is not used in prescriptions on account of its power to counteract disagreeable flavours, but on account of its healing and soothing qualities. It is a well known cure for colds on the chest, influenza, sore throat, &c., taken with hot milk or lemon.

As a cure for constipation a dessertspoonful in a glass of hot water night and morning will nearly always cure this trouble.

Being antiseptic and drawing, it is a wonderful remedy for boils, carbuncles, septic poisoning, and is used by many doctors in prescriptions for pastes for these diseases, making lancing or cutting unnecessary except in late treatment or very severe cases. A simple paste for this purpose may be made with a dense honey; preferably dark coloured, as this contains more iron and tannic acid; mixed with flour, applied to the place on a piece of lint and covered with oiled silk or jaconet and renewed two or three times a day. This has a powerful drawing action and will cause the rupture or opening of the skin, allowing the pus to drain out, and there will be no scar left. The writer has personal proof of the efficiency of this treatment in the case of severe septic poisoning. Boils are usually relieved in a few days, but carbuncles, being more persistent, may take weeks of treatment.

Similar treatment to the above is excellent for burns and scalds, and is also a cure for piles.

The following is an extract in regard to the use of honey as a cure for toothache:—"It is my honest opinion that no living person knows the therapeutic value of honey. How many persons know that is it a wonder remedy for toothache, even where one is suffering from an abscess. Just take a big swallow in the mouth and hold around the affected tooth for a while. It usually does the trick in a few minutes. I have never known it fail. I have sold numbers of people honey for this specific purpose and everyone of them, without exception, has told me that it worked like a charm." (Emmett Baxter, Philadelphia.)

Honey is also an excellent cure for bee stings, especially if applied as a paste and covered up. For frost bites on ears, fingers, &c., apply honey or honey flour paste and wrap up.

For inflamed and sore eyes, a drop or two or liquid honey put in the eyes several times has been known to bring wonderful results, when all else has failed.

Equal parts of honey and cream mixed together is an excellent cosmetic, softening and beautifying the skin, and is said to be a good remedy for freckles.

A splendid candy for colds, coughs, &c., can be made as follows:—Boil a strong solution of horehound leaves in soft water, strain through muslin, add as much honey as desired, boil until all the water evaporates, pour in shallow vessel, and allow to set.

THE KITCHEN GARDEN

To grow cabbages well plenty of manure should be used. There is no manure to which this crop responds so well as animal. For heavy lands horse manure, and for light soils cow or pig are respectively the best when they can be obtained. If the soil is of a poor quality, dig the ground two spits deep, and put a good layer of manure between the two spits. This is especially necessary in the case of autumn or summer crops, which have to stand a dry spell. Spring cabbage—that is, those that are planted in the autumn for use in the spring—do well if planted on ground that has been well worked and manured previously for peas or onions, and on such ground cabbages can be planted without any fresh manure being added. Of other manures lime is an important factor in successful cabbage culture; it is chemically and mechanically beneficial to the soil and the cabbage tuber. It should be applied at the rate of about 2 lb. to the square yard, and is particularly necessary to heavy soils and those rich in humus. Superphosphate at the rate of 2 oz. to the square yard is good, but should not be applied at the same time as lime or to soils that are infected with club root. When the crop is nicely established, apply 1 oz. of sulphate of ammonia to heavy, damp land, or 1 oz. of nitrate of soda per square yard in the case of light or sandy soil. Nitrate of soda is a splendid fertilizer for the cabbage family. When especially

fine heads are required, water the plants once or twice during the growing season with the following mixture:—1 oz. of iron sulphate and 2 oz. of sulphate of ammonia dissolved in 1 gallon of water.

Now is the time when the kitchen garden will richly repay all the labour bestowed upon it, for it is the month for sowing many kinds of vegetables. If the soil is not naturally rich, make it so by a liberal application of stable manure and compost. Manure for the garden during summer should be in the liquid form for preference. Failing a sufficient supply of this, artificials may be used with good results. Dig or plough the ground deeply, and afterwards keep the surface in good tilth about the crops. Water early in the morning or late in the evening, and in the latter case stir the soil early next day to prevent caking. Mulching with straw, leaves, or litter will be a great benefit as the season becomes hotter. It is a good thing to apply a little salt to newly-dug beds. What the action of salt is is not exactly known, but when it is applied as a top dressing it tends to check rank growth. A little is excellent for cabbages, and especially for asparagus, but too much renders the soil sterile and causes hardpan to form. French or kidney beans may now be sown in all parts of the State. The Lima bean delights in the hottest weather. Sow the dwarf kinds in drills 3 ft. apart and 18 in. between the plants, and the climbing sorts 6 ft. each way. Sow Guada beans, providing a trellis for them to climb on later. Sow cucumbers, melons, marrows, and squash at once. If they are troubled by the red beetle, spray with Paris green or London purple. In cool districts peas and even some beetroot may be sown. Set out egg plants in rows 4 ft. apart. Plant out tomatoes 3½ ft. each way, and train them to a single stem, either on stakes, trellis, or wire netting. Plant out rosellas. Sow mustard and cress, spinach, lettuce, vegetable marrows, custard marrows, parsnips, carrots, chicory, eschalots, cabbage, radishes, kohl-rabi, &c. These will prove satisfactory provided the ground is well worked, kept clean, and that water, manure, and, where required, shade are provided.

Fresh vegetables, especially vegetables containing vitamins, are essential to good, robust health, and medical men are now advising people to "eat more vegetables."

The growing of vegetables not only means a saving of money, but educates the children by inculcating a desire to have their own gardens in later life, and so help to keep down the costs of living.

Vegetable-growing is not only a healthy occupation, but it also provides exercise and recreation. In the suburbs it has a tendency to keep young people contented at home, and to trouble less about going to horse races and places of gambling. With country people who, perhaps, are less in need of exercise, gardening is a delightful hobby.

It enables private gardeners to improve the strains of vegetables by a careful selection of seed, much in the same way that a flockmaster improves his sheep; and much satisfaction, and, not unusually, generous reward, are to be gained from this work.

The home garden enables the testing out, in a small way, of the newer varieties of vegetables, which work is not always possible, or, if it is possible, not payable with the professional or commercial gardener. The amateur gardener will find this work both fascinating and health-giving.

Given suitable soil conditions, the various culinary herbs (sage, thyme, marjoram, mint, &c.) are easily cultivated in Queensland, and every garden should have at least sufficient plants for home requirements. Commercial production, too, presents possibilities, especially of those herbs which are sold in a green state, the chief of which are mint and parsley. During the winter months a demand exists for both these herbs. Under cool conditions little growth is made, and some growers have therefore resorted to production under glass, especially in the case of parsley. The increased popularity of peas as a vegetable has tended to the more extensive use of mint at all seasons of the year. Owing to the necessity for freshness in the product, the metropolitan market for mint and parsley is supplied by suburban growers.

There is some household demand for dried herbs, which are used also by butchers for the flavouring of sausages. The consumption is very limited, however, and those contemplating commercial production are therefore advised first to make sure of a market for their produce.

For the successful cultivation of herbs a rich, loamy, friable soil is necessary, and a plentiful supply of water must be available during their growing period. Wherever possible, the soil should be dug to a depth of 9 to 10 inches and should be well supplied with well-decomposed stable manure. As the seeds of all these herbs are fairly small, it is necessary to cultivate the soil to a fine tilth.

The Care of the Eyes in Western Queensland.

The subjoined notes on this important subject are by Dr. L. St. Vincent Welch, Chief Medical Officer of Schools, and are published by authority of the Hon. F. A. Cooper, Minister for Public Instruction.

Two Common Eye Diseases.

Certain diseases of the conjunctiva, or moist surface of the eyes and eyelids, are more prevalent in Western Queensland than in the districts nearer the coast. Of several diseases the chief are—

1. Acute conjunctivitis, often known as "blight," in which the eyes are red, discharging, and often swollen;

2. Trachoma, in which the inner surface of the lids becomes rough and "granular."

Under treatment the first of these usually recovers completely and rapidly, but trachoma nearly always has a prolonged course, and often causes serious loss of sight or even blindness. It is trachoma which constitutes the really serious eye trouble in the West, though no doubt the acute conjunctivitis so common in the fly season is more spectacular in appearance. Much can be done, and everything possible should be done, to prevent the occurrence of both these diseases, but especially does this apply to trachoma, for not only is it the more serious disease, but it is the less highly infectious and therefore the more readily preventable.

Reasons for Prevalence.

The greater prevalence of conjunctival disease in the West is no doubt due in part to the dryness, glare, dust, and flies, factors which either render the eyes more susceptible to disease or, as in the case of dust and flies, carry the infective material to the eyes. The difficulty of providing an ample diet containing fresh milk, meat, fruit, and vegetables probably often lowers the natural resistance and increases the susceptibility to disease, and may thus also be a factor in the occurrence of trachoma, if not of acute conjunctivitis.

The essential cause, however, of both diseases is the occurrence and conveyance of the infection for, without this infection, people in the West have quite as healthy eyes as those dwelling nearer the coast.

Great Majority have Healthy Eyes.

In a recent inspection of school children in the South-Western districts about 80 per cent. were found to have eyes that would compare favourably with those of children around Brisbane. This shows that it is neither the climate, dust, nor glare that can be blamed for 10 per cent. suffering from trachoma, and that there is no reason why everyone in the West should not have as good eyes as people in other districts.

Actually some of the centres visited, not always those most favourably situated, were remarkable free from eye disease. Every place should be free.

Need for Care to Prevent Infection.

The frequency with which whole families are affected, one or both parents showing old-standing trachoma, while other families living in similar conditions have healthy eyes shows the care that should be taken to prevent the spread of the disease as well as the benefits to be gained by taking that care.

It is plainly the duty of everyone in those parts where trachoma is prevalent to take all reasonable precautions to avoid acquiring the disease, and it is especially the duty of those who are suffering or have suffered from trachoma to take unceasing care to avoid giving it to others.

Persistent care may be tedious and troublesome, but surely no trouble can be considered too great to get rid of a serious and disabling disease. Indeed, could anything be more discreditable to a community than the continued existence of a preventable disease?

Preventive Measures.

Of all requirements in discouraging the spread of infection from one to another we may put first and foremost soap and water. Scrupulous cleanliness—a general personal cleanliness as well as of the face and eyes—is all important. Children's faces should be washed as often as necessary, and not less than thrice daily.

The eyes should, if possible, be bathed with some simple lotion—such as boracic, a teaspoonful to a pint of water—thrice daily or as often as there is any discharge to be washed away. No dried discharge—so-called "sleep"—should be allowed to remain about the eyes.

Everything must be done to prevent the infection being carried from infected eyes to those that are not infected, and it must be remembered that it is by no means easy for any person not trained in eye work to know who may or may not be suffering from trachoma in a mild form.

Separate basins and separate towels, sponges, &c., are very important. One could hardly imagine a more likely way of spreading infection from one to another than the use of the same towel to wipe the face and eyes.

For a similar reason children should not share the same bed, for obviously infection would be likely to get from one to another either direct or on the pillow and bedclothes. All possible precautions should be taken to prevent flies conveying the infection. Fly-veils should be worn during the season when flies are prevalent. Children, particularly, must be taught not to tolerate flies in and about their eyes.

When sore eyes do occur a doctor should be consulted if one is available. It is very important that all cases of acute conjunctivitis, or "blight," should be thoroughly treated until the eyes are quite healthy again, for there is some reason to suspect that trachoma is especially liable to become established during and following an attack of acute conjunctivitis.

Treatment of Affected Eyes.

It is possible only to give general directions as to treatment where the services of a doctor are not available. It must be fully understood

that all sore eyes are not cases of acute conjunctivitis or trachoma. Many other eye troubles—sometimes very serious ones—are liable to be regarded as "blight" in the West or as "a cold in the eye" in other places, and these affections may require quite different treatment. Trachoma and acute conjunctivitis are both liable to complications requiring special treatment. The proper treatment for each case could only be advised by someone with a knowledge of eye diseases, and it is important that for any sore eye a doctor should be consulted, if possible.

For the usual simple case of conjunctivitis, whether acute "blight" or the chronic trachoma, treatment is directed chiefly to assisting Nature to effect the cure, for it is undesirable, without risk of damaging the eyes, to use the strong antiseptics that could be applied elsewhere, and only mild antiseptics and treatment are advisable except in the hands of those who know what they are doing and how to use them.

To help Nature in her own defensive process, the chief thing is to keep the eyes clean and free from any irritating and infective discharge. The eyes should be well bathed with boracic lotion thrice daily; when suffering from acute conjunctivitis or "blight" the eyes should be bathed more frequently—as frequently as there is any discharge to be removed. To help in destroying germs some mild antiseptic drops are desirable. Probably the common zinc sulphate ($\frac{1}{2}$ per cent.) and boracic lotion obtainable at any chemist's is the most efficient and safest for use where medical advice is not available, and two or three drops should be dropped into the eyes thrice daily after bathing with boracic.

It will be understood that in those places where children receive treatment through the kindness of the teacher this does not do away with the necessity of home treatment and care, for a treatment once daily on school days is not sufficient. Moreover, the welfare of a child's eyes is the responsibility of the parents, not of the teacher, though many teachers are kind enough to help in combating the eye troubles among their pupils.

For trachoma the possible home treatment is the same as for acute conjunctivitis, but must be prolonged—in most cases probably for two years or so. The disease is so resistant to treatment and so liable to lead to permanent injury to the sight that every effort should be made to get treatment under the best possible conditions.

Of no disease can it be more truly said that prevention is better than cure. There should be no trachoma to require treatment.

TO SUBSCRIBERS—IMPORTANT.

Several subscriptions have been received recently under cover of unsigned letters. Obviously, in the circumstances, it is impossible to send the Journal to the subscribers concerned.

It is most important that every subscriber's name and address should be written plainly, preferably in block letters, in order to avoid mistakes in addresses and delay in despatch.

"The Farm Produce Agents Acts, 1917 to 1932."

In the matter of a breach of the above Acts by Frederick C. Keehn, trading as Queensland Fruit Distributors, of Brisbane, in the State of Queensland, Licensed Farm Produce Agent.

Notice is hereby given that it is the intention of the Minister to cause the moneys or part of the moneys paid to His Majesty under the Bond given on behalf of the abovementioned on the commission by the said Frederick C. Keehn, trading as Queensland Fruit Distributors of a breach of the Acts to be paid or applied in making compensation to persons who have suffered damage by reason of such breach.

Any person having any claim in respect of such damage must produce his proof of damage to me not later than twenty-eight days after the publication of this notice.

Dated this twenty-seventh day of July, 1934.

W. GETTONS,
Registrar, Farm Produce Agents,
Department of Agriculture and Stock, Brisbane.

Plate 128.
Brisbane River at Colledge's Crossing, near Ipswich.

PLATE 129.
The Bremer, near Ipswich, Queensland.

PLATE 130.
Lake Manchester, near Brisbane, Queensland.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF JUNE, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING JUNE, 1934, AND 1933, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	June.	No. of Years' Records.	June. 1934.	June. 1933.
North Coast.	In.		In.	In.
Atherton	1·62	33	2·74	2·83
Cairns	2·84	52	1·71	4·23
Cardwell	2·00	62	3·38	2·54
Cooktown	2·02	58	0·20	1·79
Herberton	1·11	48	2·73	1·73
Ingham	2·32	42	3·83	3·30
Innisfail	7·15	53	7·49	7·75
Mossman Mill ..	2·13	21	1·02	3·17
Townsville	1·32	63	2·39	3·88
Central Coast.				
Ayr	1·45	47	1·40	4·13
Bowen	1·61	63	1·75	2·89
Charters Towers ..	1·26	52	0·52	1·45
Mackay	2·63	63	4·03	3·02
Proserpine	3·29	31	1·54	3·23
St. Lawrence ..	2·50	63	1·56	1·45
South Coast.				
Biggenden	2·19	35	3·52	1·59
Bundaberg	2·87	51	3·77	2·45
Brisbane	2·75	83	0·76	1·37
Caboolture	2·78	47	1·46	1·42
Childers	2·52	39	2·30	1·94
Crohamhurst ..	4·65	41	1·60	2·00
Esk	2·30	47	0·89	0·67
Gayndah	1·83	63	2·54	1·00
Gympie	2·72	64	1·44	1·84
Kilkivan	2·13	55	2·47	1·52
Maryborough ..	3·06	63	1·49	2·28
Nambour	3·89	38	1·35	2·44
Nanango	2·03	52	1·41	0·71
Rockhampton ..	2·59	63	2·29	1·55
Woodford	2·99	47	1·41	1·01

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	June.	No. of Years' Records.	June. 1934.	June. 1933.
Central Highlands.	In.		In.	In.
Clermont	1·69	63	1·18	3·31
Gindie	1·43	35	2·62	1·00
Springsure ..	1·76	65	3·04	1·79
Darling Downs.				
Dalby	1·69	64	1·60	1·02
Emu Vale ..	1·55	38	1·18	1·28
Hermitage ..	1·85	28	..	1·26
Jimbour	1·70	46	1·29	0·76
Miles	1·82	49	1·67	2·11
Stanthorpe	1·95	61	0·94	2·49
Toowoomba ..	2·45	62	1·11	0·71
Warwick	1·78	69	0·64	1·39
Maranoa.				
Roma	1·60	60	1·06	0·94
State Farms, &c.				
Bungeworgorai ..	1·38	20	0·99	0·90
Gatton College ..	1·90	35	0·79	1·03
Kairi	1·37	20	3·13	2·33
Mackay Sugar Experiment Station	2·34	37	2·47	3·53

J. H. HARTSHORN, Acting Divisional Meteorologist.

CLIMATOLOGICAL TABLE—JUNE, 1934.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·96	79	69	84	5	61	25	20	2
Herberton	..	69	56	77	6	48	18	273	8
Rockhampton	30·12	74	54	81	1, 4	42	12	229	10
Brisbane	30·16	69	48	76	21	40	12	76	4
Darling Downs.									
Dalby	30·17	67	37	72	1, 23	27	11	160	4
Stanthorpe	..	59	30	67	5	17	9	94	4
Toowoomba	..	62	39	68	6	30	9, 28	111	4
Mid-Interior.									
Georgetown	29·98	84	58	89	23	48	11, 12	13	2
Longreach	30·09	75	47	84	4, 5	37	12	100	2
Mitchell	30·17	67	35	75	22	25	12	54	5
Western.									
Burketown	30·00	84	60	90	5	55	9, 13, 19, 27, 28	Nil	..
Boulia	30·08	73	47	86	21	40	19, 12	54	3
Thargomindah	30·15	66	43	78	14	34	10	98	5

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	August, 1934.		September, 1934.		MOONRISE. August, 1934.	MOONRISE. Sept. 1934.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	a.m.
1	6·35	5·21	6·7	5·37	11·32	12·21
2	6·34	5·22	6·6	5·37	a.m.	1·17
3	6·33	5·23	6·5	5·38	12·33	2·9
4	6·32	5·23	6·4	5·38	1·30	2·54
5	6·32	5·24	6·3	5·39	2·27	3·38
6	6·31	5·24	6·2	5·39	3·20	4·14
7	6·31	5·25	6·1	5·40	4·10	4·46
8	6·30	5·25	6·0	5·40	4·55	5·18
9	6·29	5·26	5·59	5·41	5·37	5·46
10	6·29	5·26	5·57	5·41	6·10	6·14
11	6·28	5·27	5·56	5·42	6·42	6·44
12	6·27	5·27	5·55	5·42	7·14	7·13
13	6·26	5·28	5·53	5·43	7·39	7·47
14	6·25	5·28	5·52	5·43	8·9	8·28
15	6·24	5·29	5·51	5·44	8·38	9·15
16	6·23	5·30	5·50	5·44	9·9	10·9
17	6·22	5·30	5·49	5·44	9·47	11·11
						p.m.
18	6·21	5·31	5·48	5·45	10 29	12·16
19	6·20	5·31	5·46	5·45	11·18	1·23
					p.m.	
20	6·19	5·32	5·45	5·46	12·17	2·33
21	6·18	5·32	5·44	5·46	1·22	3·42
22	6·18	5·32	5·43	5·47	2·31	4·47
23	6·17	5·33	5·42	5·47	3·43	5·52
24	6·16	5·33	5·41	5·47	4·51	6·59
25	6·15	5·34	5·40	5·48	6·4	8·3
26	6·14	5·34	5·39	5·48	7·9	9·6
27	6·13	5·35	5·37	5·49	8·14	10·8
28	6·12	5·35	5·36	5·49	9·17	11·6
29	6.11	5.36	5·35	5·50	10·20	12·0
30	6·10	5·36	5 34	5 50	11·22	..
31	6·9	5·37			..	..

Phases of the Moon, Occultations, &c.

2 Aug.	☽ Last Quarter	4 27 p.m.
10 ,,	● New Moon	6 46 p.m.
18 ,,	☾ First Quarter	2 33 p.m.
25 ,,	○ Full Moon	5 37 a.m.

Apogee, 9th August, at 7·12 a.m.
Perigee, 24th August, at 5·48 a.m.

The greatest astronomical event of this month will be an annular eclipse of the Sun on the 10th, to be seen best at Bulawayo, the largest town in Rhodesia, and at other places in South Africa where the ring of the Sun's face left uncovered by the Moon at the extreme phase will amount to only $\frac{7}{80}$ of its bright surface; thus permitting an annular eclipse to be seen to the greatest advantage if clouds do not intervene. As this will occur 1 hour 46 minutes after sunset at Warwick no glimpse of it will be caught in Queensland.

On the 1st and 2nd the approach of Venus to Mars will be noticeable. They will be apparently in the constellation Gemini, about 1½ degrees further north than Delta Geminorum, the star near which Pluto was discovered four and a-half years ago. Venus will be of much less brilliance than in March last and Mars far from its best.

The Moon will be passing from west to east of Venus, about 2 degrees on its northern side at 7 a.m. on the 8th.

Saturn will be in opposition to the Sun on the 18th, and will, therefore, rise very nearly at the time of sunset and set about the time of sunrise, thus being within reach of telescopes all night. The Sun's apparent movement eastward will soon bring about a change, causing Saturn to rise and set earlier, so that the earlier setting of Saturn will reduce its time of visibility by 27 minutes on the 31st.

The occultation of Antares, the principal star in Scorpio, will take place in broad daylight, about 2 p.m., on 19th August, but the Moon, being rather more than half full, high up in the north east by east, an interesting opportunity for amateurs with telescopes to find Antares on the eastern side of the Moon will be afforded.

The Moon will pass within 3 degrees of Saturn on its northern side at 9 p.m. on the 24th, but the Moon being all but full Saturn will scarcely be visible to general observers.

Mercury will be in superior conjunction with the Sun on the 26th, when it will be about 36 million miles beyond it, but not exactly behind it; Mercury then being about 1½ degrees more northward.

Mercury rises at 5.17 a.m. (1 hour 18 minutes before the Sun) on the 1st; on the 15th it rises only 35 min. before the Sun.

1 Sept.	☽ Last Quarter	5 40 a.m.
9 ,,	● New Moon	10 20 a.m.
16 ,,	☾ First Quarter	10 26 p.m.
23 ,,	○ Full Moon	2 19 p.m.
30 ,,	Last Quarter	10 29 p.m.

Apogee, 5th September, at 4.6 p.m.
Perigee, 21st September, at 11.6 a.m.

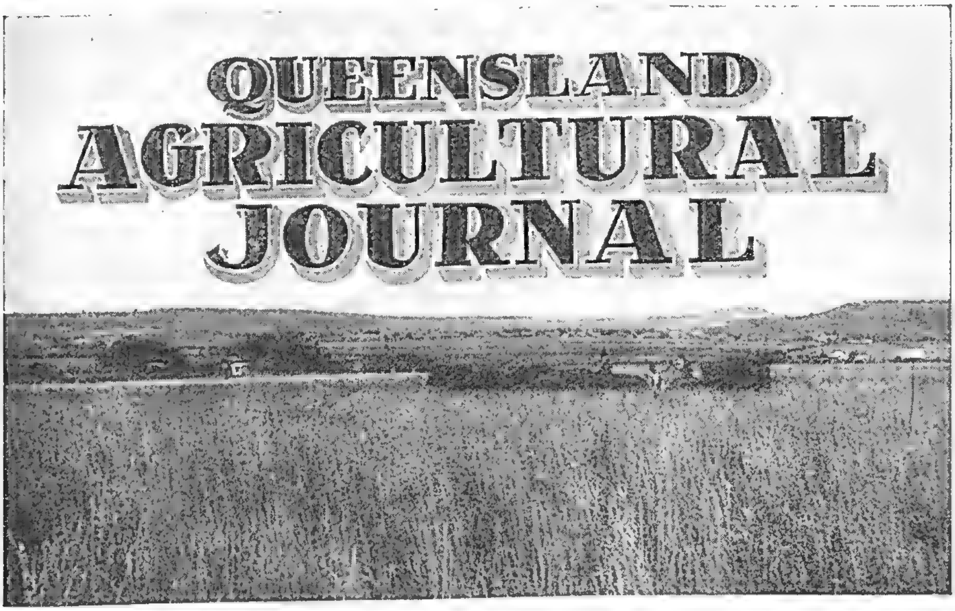
For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

ANNUAL RATES OF SUBSCRIPTION.

Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling.** Members of Agricultural Societies, **Five Shillings,** including postage. General Public, **Ten Shillings,** including postage.



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Event and Comment.

Return of the Premier.

NO returning statesman could have had a warmer welcome home than that given to the Premier, Hon. W. Forgan Smith, by a crowd of several thousand people, on his arrival in Brisbane on 12th August from his mission to Great Britain on behalf of the primary producers of this State. The vast gathering was representative of every section of the community, and the reception accorded the Premier was remarkable for its enthusiasm and obvious sincerity. As the Sydney mail steamed into the station, the Caledonian Pipe Band played an inspiring welcome.

In the course of an address from a dais on the railway platform Mr. Forgan Smith said that he was glad to be back among the people of Queensland and to receive such a splendid greeting. He had left Brisbane for a purpose connected with the welfare of the State, and he was happy to say he was perfectly satisfied with the result of his mission.

On his visit overseas he received every courtesy and consideration from members of the British Government, from public bodies, and from the people.

He not only entered into negotiations with members of the Government, but he took the opportunity, through the press and at public gatherings, to put the case for Queensland and Australia. That case was listened to with considerable attention and sympathy, and he was satisfied that the people of Great Britain were entirely sympathetic with the people of this country. Their aims and aspirations were similar to those of Australians, and they were favourable to trade with this country. However, he found there was a great deal of misconception about Australian conditions.

"There is a feeling in Europe to-day," he said, "that is having its effect on Government policy, is preventing recovery, and is the most serious menace of all to the return to normal employment. I refer to that form of insanity known as economic nationalism—the idea that people can sell without themselves being purchasers. As a consequence barriers are being built up in foreign European countries in the hope of improving things; but inevitably the result is reflected in the poverty of their people, lack of development, and, worst of all, suspicion between nations that may lead to serious results. However, to a large extent that feeling is passing away."

While in Great Britain he pointed out that the people of that country were taking more imports from foreign countries than from all the Dominions and the Crown Colonies put together. He had told Britain that the competition of Australia in the markets of the United Kingdom was not with the local farmer but with other countries. On the figures available there was no case of any kind in favour of restriction of Dominion produce. The whole system was based on an economic fallacy, which Australia, in its own interests, must at all times resist.

There could be no justification for restricting the bounty of nature while thousands of people had insufficient of the necessities of decent livelihood. The solution of the problem lay in giving the people access to the bounty of nature, and to make use of the improvements and comforts that modern science had made available to man. Better distribution and an increase in consumption were required rather than restriction. No remedy could be found for improvement in world conditions in advocating a policy of restriction. Furthermore, Australia could never agree, as any part of a definite policy, to sharing her markets with other countries.

Any form of quotas must inevitably benefit only the older countries. As an example, in the dairying industry Denmark was the chief competitor. Denmark was carrying every hoof its pastures could carry, and any quotas based on existing output must stabilise the market for that country. On the other hand Australia's capacity to expand was unlimited, and in its own interests the nation could never agree to a policy of restricted development.

Mr. Forgan Smith added that his visit to Britain had been propitious. The case he was able to put to the British Government and, through the press and on the public platform, to the people could result in nothing but good, and the assurances he had received from the British Government were to the benefit of this country. Particularly was that true in regard to the sugar and dairying industries.

"The future is with us if we are resolute," added the Premier. "We require to do a great deal ourselves to improve the conditions of

our industry. We must produce goods of excellence and make known their merit to possible customers. That could be done by the organisation of markets in parts of Britain."

Generally he was satisfied with the result of his mission, and he was looking forward with restored health to carrying on his work for the development of Queensland. Lands he had visited were confronted with problems similar to our own, but his considered view, as a result of his experience, was that it was a grand thing to be connected with such a country as Queensland and a great privilege to be a citizen of Australia.

Animal Health—Research Work at Yeerongpilly.

DISCUSSING the invaluable research work being done at the Animal Health Station at Yeerongpilly recently, the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, said, *inter alia,* that the modern conception of nutrition is entirely different from the views earlier held. A hundred years ago foodstuffs were not recognised very definitely in relation to their food values, but every country in the world to-day is endeavouring to demonstrate the economic importance of food, and to see that every food constituent is in its right proportion to every other constituent. Research work along those lines is likely to help the production of stock in the most economic way. For instance, it is well known that protein is the most expensive constituent in the balanced ration; and, that being so, it became necessary to determine the minimum amount of protein that should be fed. In order that the stockowners in Queensland may be advised on this most important matter an officer is stationed at Yeerongpilly whose sole duty consists of compiling experimental data in relation to foodstuffs.

At the present time his work is confined to observing the effects of foodstuffs on pigs and poultry, and already some remarkable data have been assembled. There is every reason to anticipate valuable results from this research, benefiting not only pig and poultry raisers, but animal husbandmen generally.

Research also was being prosecuted at Yeerongpilly with respect to parasite life in stock, which was likely to lead to valuable and important results.

One thing necessary is the creation of a public conscience among farmers so that the work done at Yeerongpilly may be duly appreciated, for experience has shown that farmers will not avail themselves of an organisation unless they know something about it.

It has been the practice, therefore, during the past twelve months, to invite leading dairymen from different parts of Queensland to come to Yeerongpilly and stay several days there. Many classes have been held, in which there has been a happy combination of practical work and theoretical instruction, with most gratifying results. Farmers who had taken advantage of this opportunity went back to their own districts very favourably impressed with the organisation at Yeerongpilly, recognising that it was a very definite and valuable help to the farming community.

Invaluable service also was rendered by the staff of Yeerongpilly, both to the farmers and to the community in general, by the diagnoses made of stock diseases at the animal health station. Arrangements had been made whereby primary producers in any part of the State could send the viscera of animals or other specimens for examination.

Rice Weevil in Maize.

ROBERT VEITCH, B.Sc.Agr., B.Sc.For., F.R.E.S., Chief Entomologist.

THE rice weevil, *Sitophilus oryzæ* L., is quite definitely the most destructive grain pest in this State, its unenviable reputation being due mainly to the fact that it inflicts very severe losses on maize and wheat.

As its name indicates, it was originally found attacking rice, but in the years intervening since it was first studied many other foodstuffs have been recorded as being attacked, maize, wheat, oats, barley, sorghum, macaroni, biscuits, and prepared breakfast foods being the most frequent sufferers.

Stanthorpe readers will remember that during the 1931-32 season the rice weevil was quite frequently found attacking apples both in the packing sheds and on the trees. Although the weevil grubs were often found feeding in the fruit no weevils were bred from such apples, but the blemishes were sufficient to warrant the rejection of attacked fruit. Such an occurrence is, of course, rather unusual, but it serves to indicate the wide range of foods subject to attack by this notorious pest.

Although commerce has ensured world-wide distribution from its Indian home, the rice weevil is predominantly a tropical and subtropical species, and in such regions it breeds more or less continuously and soon destroys suceptible grain left unprotected from its ravages.

Life History.

The first point of interest to be noted in the life history of this species is the fact that the weevil lives for about four or five months and during that time it can lay as many as four hundred eggs. Each of these eggs is deposited in a very small cavity gouged out by the weevil on the surface of the grain, each egg cavity being cemented over by a secretion which makes its detection somewhat difficult. As a reasonably large proportion of these eggs hatch it is obvious that even a small initial infestation may rapidly assume serious proportions, particularly during the warmer weather.

A soft white legless grub hatches from the egg after an incubation period of a few days and proceeds to feed inside the grain. This grub becomes full-grown in two or three weeks and then transforms to the pupa from which the final stage in the insect's life, namely the weevil, emerges a week later to feed, mate, and repeat the life cycle. The weevil is a dark-brown hard-bodied insect about one-sixth of an inch in length with a long downwardly projecting snout, a further characteristic feature being the occurrence of four reddish spots on the back. These lighter patches are not present in the closely allied species known as the granary weevil, *Sitophilus granaria* L., which furthermore is slightly larger than the rice weevil and is unable to fly. The granary weevil possesses habits similar to those noted in the discussion of the rice weevil, but seems partial to colder regions whereas the rice weevil, as already indicated, shows a marked preference for warmer countries.

The life cycle of the rice weevil may be completed in less than a month, but such rapid development occurs only during summer, and in the colder weather a much longer period is required for its completion. The number of generations occurring in Queensland each year is not definitely known, but overseas, under somewhat comparable conditions, there are usually six or seven generations annually.

Serious infestation may reduce large masses of grain to an almost valueless powder, and this is particularly so when grain is unavoidably subject to long storage or to prolonged voyages in slow cargo vessels. Much the greater part of the damage is inflicted by the weevil grubs, but the weevils themselves also nibble at the grain, thereby assisting their offspring in the work of destruction.

Control Measures.

Measures for the control of this pest may be discussed under three headings—firstly, cultural practices tending to minimise infestation of the crop in the field; secondly, fumigation of the stored grain once it has become infested; and, thirdly, natural control by insect enemies of the weevil.

It will probably be most satisfactory to dispose of the natural enemies first, because the control measure constituted by these natural enemies is quite the least useful of the three just mentioned. Not infrequently small wasp parasites are bred from infested grain, but the general experience is that such parasites do not become at all common until the grain is very heavily infested, and the damage has then pretty nearly reached its peak. The writer has frequently observed the same disappointing late association of parasites with the pea and bean weevils commonly responsible for the almost total destruction of cowpea seed. It may be taken as practically certain that the possibility of reasonable control by parasites offers no prospects of success.

Turning now to measures which may be taken to minimise infestation of the growing crop, it is interesting to note that the rice weevil does not usually eat through the husks of maize; hence where the choice is possible a maizegrower should select a variety producing a long, tightly fitting husk. The next important point is to ensure that any maize crop exposed to attack is harvested as soon as it is mature, thereby reducing to a minimum the period of exposure to danger. The third important point is to eliminate as far as practicable the sources of infestation in a new crop, and in this connection the best procedure is to destroy as much waste maize material as possible, both in the field and in the barn. In such waste material the weevils can continue breeding on a large scale during the period elapsing between crops. It is here necessary to emphasise a fact that is not well known, and that is that the rice weevil possesses well-developed wings and is capable of flying, more particularly during warm weather. In late spring and early summer rice weevils leave infested barns and other grain stores and migrate to the fields of maize where they initiate an infestation which may subsequently become very serious if conditions are favourable to the development of the insect; hence the desirability of ensuring a thorough clean-up of maize stores in the vicinity of growing crops.

Even if all precautions are observed infestation of the harvested maize may occur, but nevertheless if it does ensue it should be on a lesser scale than would have been the case had no precautions been observed.

The third control measure is fumigation of stored grain, and for such a purpose carbon bisulphide is probably the most useful fumigant available under Queensland conditions.

Satisfactory results are obtainable by such fumigation, but they may be disappointing if the temperature is below 60° F., and it is generally considered that a temperature of at least 70° F. is required to obtain a reasonably good kill. For this reason fumigation should not be undertaken in cold weather, and it should start in the morning so as to obtain the benefit of the higher day temperatures.

The maize to be treated for insect infestation is placed in a suitable container, which should be as airtight as possible. The carbon bisulphide is then poured into saucers or other dishes placed on top of the grain, so that the carbon bisulphide gas, which is heavier than air, will diffuse throughout the container, which should be immediately tightly closed. Pouring the carbon bisulphide on to a few bags placed on top of the maize to be treated is sometimes preferred to pouring the fumigant into saucers, as the liquid volatilises more rapidly from the surface of the bags than from the saucers. The required lethal concentration of the gas is thus obtained earlier than is the case where saucers are used.

The general practice is to allow 4 or 5 lb. of carbon bisulphide to each 1,000 cubic feet of the container, the duration of the fumigation being thirty-six hours. The fumigated maize should then be exposed to the air to remove the gas. The germination of the maize is not normally affected by this treatment if dry and mature when treated and if the precaution of airing the seed after treatment is observed. Where infestation is severe a second fumigation may be necessary two or three weeks after the first.

The quantity of carbon bisulphide required for each 1,000 cubic feet of the container has been given as 4 or 5 lb., but it is necessary to add that such a figure is based on the assumption that the container is reasonably airtight. If the owner suspects a high degree of leakage then the quantity of carbon bisulphide should be increased.

Obviously, reinfestation of fumigated maize may ensue if steps are not taken to prevent it; hence the usual procedure is to store the treated grain in thoroughly clean and closely-sealed containers, giving little chance of reinfestation.

Before leaving the subject of carbon bisulphide fumigation readers are reminded that this chemical must be handled with a certain amount of discretion. It evaporates rapidly on exposure to the air and forms a gas which is highly explosive and inflammable. Farmers using it should, therefore, make certain that it does not come into contact with a flame or highly heated pipes, or any other highly heated material. Furthermore, it is desirable to refrain from smoking when using carbon bisulphide. The operator should also make every effort to avoid inhaling the gas, for serious consequences will ensue if this precaution is not observed. With the exercise of common sense, however, the fumigant can be handled with quite a reasonable degree of safety.

Other fumigants are available for dealing with grain infested by the rice weevil, but they are not likely to displace carbon bisulphide under existing Queensland conditions. Heat treatment may also be

used for eliminating weevil infestation, a temperature in the vicinity of 140° F. being sufficient to kill the weevils if maintained for several hours. Generally, however, facilities for the application of heat treatment on an extensive scale are not available.

So far attention has been devoted almost exclusively to weevil infestation in maize, mainly because such infestation is a more or less permanent state of affairs in Queensland. Wheat, however, may sometimes be very severely attacked while in store, although large quantities of that cereal are often absolutely free from infestation. In this connection it is interesting to note that the rice weevil reacts very markedly to the moisture content of the grain in which it is breeding, and the low moisture content of many wheat crops prevents its breeding therein. Furthermore, infestation of the growing crop is not a menace as is the case with maize; hence a wheat crop harvested in a sound, dry condition and maintained in such a state under adequate storage precautions normally has a reasonably good chance of remaining commercially free from infestation.

STRAINING WIRE NETTING.

A simple and efficient wire-netting fence is shown in the drawing. It consists of two lengths of 2 inches by 6 inches wood with two or three bolts passed through them so that they can be securely clamped to the end of the fencing as shown. A

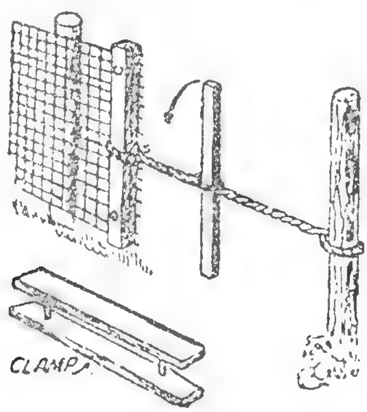

PLATE 131.

heavy rope is passed round both pieces, around a fence post, and tied. A stout stick is used to twist the rope, thus, pulling the fence as tight as desired. The device can be made in a short time from material that can be found on every farm.

Sterility in Dairy Cows.

By K. S. McINTOSH, H.D.A., B.V.Sc., Veterinary Officer, Animal Health Station, Yeerongpilly.

FROM observations made by field officers of the Department and numerous inquiries at this Station it is evident that sterility among dairy herds of Queensland is fairly widespread.

The losses due to sterility are not spectacular as in the case of rapidly fatal diseases, but their very insidiousness often allows the condition to become well established before any action is taken by the stockowner.

The lack of accurate breeding records and the reliance of the dairy farmer on memory tend to make him overlook irregularities in breeding, but the economic loss caused by sterility throughout dairy districts must amount to an enormous sum each year, and it is only by intelligent and energetic individual effort on the part of dairy farmers that it can be combated.

In this short series of articles it is proposed to deal separately with each factor causing sterility to enable the farmer to deal with the problem in an intelligent manner.

The losses from sterility are due to—

1. Loss of milk supply.
2. Inability to regulate milk supply during the season.
3. Annual loss of calf.
4. Time and money lost on treatment sometimes of hopeless cases.
5. Loss of cattle (for slaughter) which fail to breed.
6. Greater strain imposed on the bull in an endeavour to get cows in calf.
7. Waste of fodder and pasturage for cattle that will not breed.

Breeding Organs of the Cow.

To understand the fundamentals of sterility we must first make a brief study of the anatomy and physiology of the breeding apparatus.

In the cow the breeding organs consist of the ovaries, Fallopian tubes, uterus, vagina, and vulva.

Reference to figs. 1 and 2 gives some idea of the relation and position of these organs.

The ovaries are small solid organs, one on each side, about the size of small almond nuts.

These during sexual heat produce the female ova or eggs which are very small cells. These ova travel down the tiny Fallopian tubes where one of them comes in contact and fuses with one of the male cells or sperms which have been introduced into the cow's vagina by the bull during service.

The male germ cell or sperm after being deposited in the vagina swims, by means of a tail, through the neck of the uterus and into the

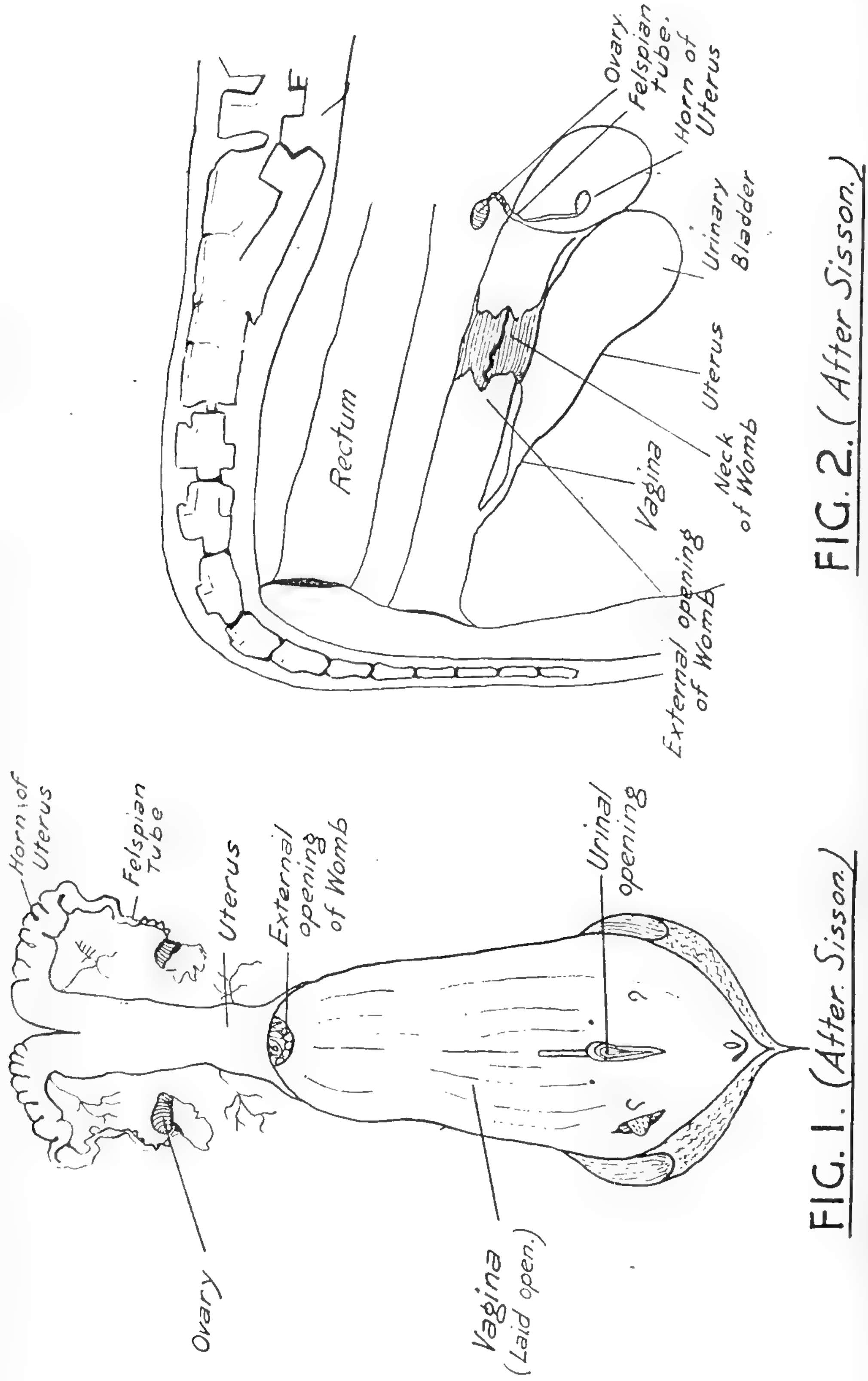

FIG. 2. (After Sisson.)

FIG. 1. (After Sisson.)

Plate 132.

body of the uterus. It is either here or in one of the Fallopian tubes that it unites with the female cell or ovum. This process of union of the male and female cells is known as conception or fertilization.

After conception the fertilized ovum begins to divide and multiply

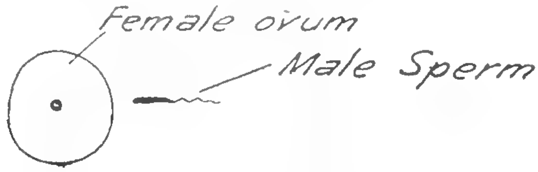

PLATE 133.

and attach itself to the wall of the uterus. From this it derives its nourishment, and, after considerable multiplication and growth, the young calf or fœtus is formed.

Causes of Sterility.

It will be seen by the foregoing that anything which prevents the union of the male and female cells or the attachment of the fertilized female cell to the wall of the uterus will cause sterility.

Conditions which cause sterility therefore may be divided into—

1. Diseases of the ovary.
2. Diseases of the uterus and Fallopian tubes.
3. Diseases of the vagina.

In the next article it is proposed to deal with diseases of the ovary and diseases of the uterus and Fallopian tube.

These will include contagious abortion, retained afterbirth, and septic conditions of the uterus.

A WIRE SPLICER.

The illustration shows a wire stretcher and splicer which has been used with success. Take a piece of $\frac{3}{8}$-inch rod 18 inches long and drill a $\frac{1}{4}$-in. hole 1 inch from one end to receive the wire to be stretched. Flatten the other end and drill a

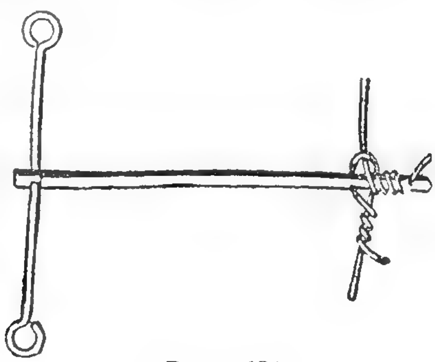

PLATE 134.

$\frac{7}{16}$-inch hole to receive a $\frac{3}{8}$ by 18-inch rod for a handle. Put it through and turn the loops on each end. The illustration shows how to use when repairing a broken wire. It can also be used as an ordinary stretcher.

Milk Fever.

K. S. McINTOSH, H.D.A., B.V.Sc.

Causes.

THE cause of milk fever is still obscure, many theories have been forwarded and many rejected. The general opinion, however, is that the enormous drain on the body resources, due to the formation of the calf, and the sudden production of large quantities of milk lowers the calcium content of body tissues and fluids resulting in the muscular spasm and paralysis of milk fever.

The sugar content of the animal seems to be closely allied to its calcium content, and some observers believe that a sudden reduction of animal sugars is responsible. Both schools of thought produce evidence to support their claims. Hence the most recent treatment is the intravenous injection of Calcium gluconate, which treatment is producing very good results.

Symptoms.

Usually the best producers are affected, the symptoms occurring within two days of calving. In mild cases staggering and paddling of the feet is noticed, and, if treated at this stage, practically all recover. Some animals show a short period of excitement and others do not. The cow goes down and cannot rise. There is a profuse flow of saliva, grinding of teeth, the neck is usually stiff, the head being carried high or turned toward one flank. In bad cases the cow is completely prostrated and lies stretched out on the ground. Secretion of milk may or may not cease. If the temperature be taken at this stage it will probably be below normal, thus "milk fever" is not a true fever.

The effects of an attack of milk fever are either death or complete recovery. Fortunately the treatment described below is fairly effective and very few cases are lost.

If antiseptic precautions are not carried out in detail, however, the treatment may be followed by an attack of mammitis.

Treatment Preventive.

Do not overfeed cows in calf. The cow should be in good condition but not fat. See that her bowels are functioning properly, and, if not, give *small* doses of epsom salts, green feed, &c. Give the cow a plentiful supply of sterilised bonemeal at all times. This assists her to maintain her supply of calcium. If milk fever is anticipated, do not strip out the cow completely for several days after calving.

Curative.

Remove any milk and inflate the udder with air. This may be done by means of a special pump, or failing this, with a bicycle pump or human enema syringe with a rubber tube and teat syphon attached. The apparatus consists of an air pump, a cylinder containing sterilised

(or medicated) cotton wool, a rubber tube, and a teat syphon (see diagram).

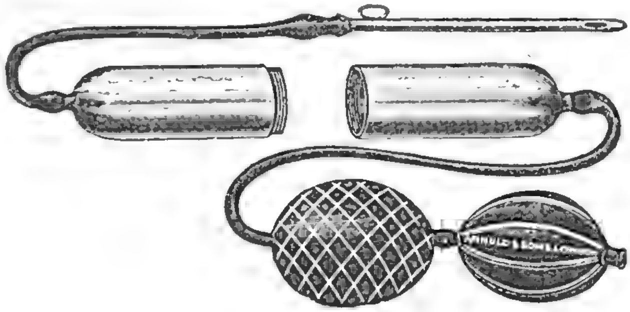

PLATE 135.
MILK FEVER AIR FILTER WITH BELLOWS.

It is extremely important that the teat syphon should be thoroughly boiled immediately before use and the operator's hands well washed.

The external opening of the teat is wiped clean with methylated spirits, the syphon is inserted, and the udder inflated until fairly firm. After all quarters have been inflated the udder is massaged gently to distribute the air.

The cow should be propped up on her brisket by means of bags of chaff or straw and turned over to the other side every hour or two. The manure should be removed by means of an enema or by hand. If she has not stood up within six hours repeat the inflation.

For several days after an attack the cow should be given green feed and bran mashes and should not be stripped out but only a moderate quantity of milk removed.

On no account should a cow with milk fever be given any medicine by the mouth.

QUEENSLAND SHOW DATES, 1934.

September.

Enoggera, 1st
Imbil, 7th and 8th
Ingham, 7th and 8th
Pomona, 12th and 13th
Innisfail, 14th and 15th
Mareeba, 20th and 21st
Beenleigh, 20th and 21st
Rocklea, 22nd
Malanda, 26th and 27th
Kenilworth, 29th

October.

Southport, 5th
Millaa Millaa, 5th and 6th
Tully, 12th and 13th

The Parasites of Sheep.

By F. H. S. ROBERTS, M.Sc., Entomologist, Animal Health Station, Yeerongpilly.

EXTERNAL PARASITES.

THE more important external parasites of the sheep in Queensland consist of lice, the sheep ked, the scrub tick, and the sheep blowflies.

SHEEP LICE.

Two species of lice are known to be present among sheep in Queensland, the red-headed sheep louse, *Bovicola ovis* L. (*Trichodectes sphærocephalus* Nitzsch), and the foot louse, *Linognathus pedalis* Osborn. They belong to the order Anoplura. The red-headed sheep louse is a member of the suborder Mallophaga, which includes all those species of lice known as biting lice.

The foot louse belongs to the suborder Siphunculata, which includes the true blood suckers. In this group the mouth parts are formed for piercing the skin and sucking up the blood and fluids.

Description.

The red-headed sheep louse has been long established in Queensland, and is a small flattened insect about one-twenty-fifth of an inch in length (Plate 136, fig. 2). The head is broader than long, reddish in colour, with prominent eyes and short three-segmented antennæ. The abdomen is pale-brownish, with a number of darker transverse bands. The legs are short and yellowish, with one terminal claw. This is the more common sheep louse, and is to be found close to the skin among the wool of the neck, shoulders, back, and thighs, though in cases of severe infestation it may occur on all parts of the body.

The foot louse has appeared among Queensland sheep only within recent years, and as yet does not appear to be by any means common. This louse (Plate 136, fig. 3) has a short bluntly pointed head, about as wide as it is long. It is much longer and broader than the biting louse, measuring up to one-twelfth of an inch in length. The mouth parts are formed for piercing and sucking. The antennæ are prominent and five-segmented, the terminal segment with three or four bristles. Eyes are absent. The legs are strong, terminating in a powerful claw. The front pair of legs are the smallest, the hind pair the largest. As in all lice, wings are absent. As its name infers, it is to be found about the feet and undersides of the legs towards the belly.

Life History.

The life histories of all species of lice are very similar, that for each species differing only in detail. The eggs, commonly known as "nits," are fastened by the female to the hair, wool, or feathers of the host. After an incubation period of several days the eggs hatch and the young lice appear. They resemble their parents except in size, and reach sexual maturity by a series of moults or castings of the skin.

The eggs of the red-headed louse hatch in from six to eight days, though in cold weather they may take as long as ten days. Sexual maturity is reached in sixteen to eighteen days after hatching.

In the case of the foot louse the eggs hatch in ten to eighteen days, the average period of incubation being about twelve days. The young lice begin to lay eggs when they are eleven to twelve days old.

Means of Spread.

Once present in a flock lice spread very rapidly. Most cases of lice infestation occur from direct contact, but it should not be forgotten that it is possible for clean sheep to become infested from yards, sheds, and paddocks which have previously housed lousy sheep.

The lice spend the whole of their life on the sheep, and can live only a short time off the host. When removed from the sheep, sucking lice live about three or four days, and biting lice six to eight days. Under such conditions the lice do not continue to lay eggs, but eggs attached to wool may continue to hatch for three weeks or longer when detached from the sheep and kept in a warm place. Young lice will live only three or four days off the sheep. Thus it will be seen that paddocks and yards containing scraps of wool detached from the sheep when rubbing and biting themselves may remain infective for at least twenty-five days. Shearing-sheds in which lousy sheep have been shorn are probably one of the greatest sources of infestation. During the process of shearing and handling the fleeces some of the parasites become detached and tags of wool containing lice and eggs are scattered throughout the shed. During cold weather dislodged lice and eggs are usually not a source of danger, as the lice become inactive and the eggs fail to hatch. This also applies to infested yards and paddocks. During warm weather, as previously mentioned, the shed may, however, be a source of infestation for twenty-five days or more.

Control and Eradication.

As lice are the cause of a fairly heavy economic loss to the sheep industry, it should be the aim of any grazier possessing lousy sheep not only to control them, but to eradicate them altogether. If clean sheep are to be introduced into an infested property, they should be placed in a paddock which has been spelled at least thirty days. By a system of paddock rotation and, of course, dipping, the eradication of lice is by no means a difficult matter. Particular attention to cleanliness in the shearing-shed is essential. If clean sheep are to follow infested sheep after shearing, there should be an interval of thirty days between shearings. If this is not practicable, the shed should be thoroughly cleaned out, all loose wool gathered and burnt, to be followed with a liberal washing out with boiling water and a good disinfectant.

For biting lice two dippings at an interval of fourteen to sixteen days are considered sufficient to eradicate them from a flock. With the foot louse, on the other hand, owing to the extended incubation period of ten to eighteen days, and to the comparatively short maturity period of eleven to twelve days, it is necessary to dip three times at ten-day intervals. Should this be impracticable with large numbers of sheep, a second dipping after the interval recommended for the biting louse will be found to give good results.

THE SHEEP "TICK."

The sheep "tick" or ked, *Melophagus ovinus*, is not really a tick, but a wingless fly. Ticks have eight legs, an inconspicuous head, and a

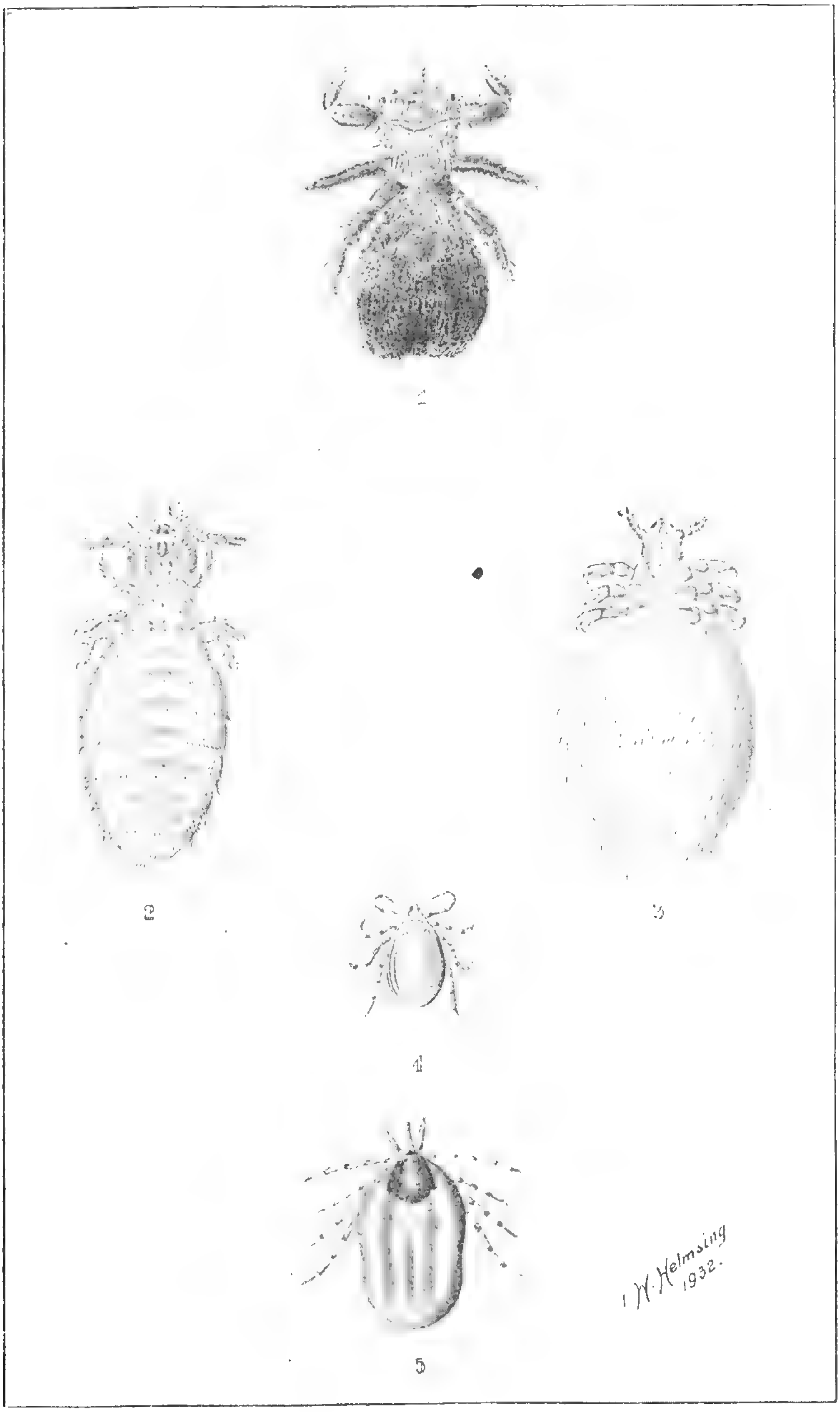

PLATE 136.—EXTERNAL PARASITES OF SHEEP.

FIG. 1—Sheep "Tick" or Ked, *Melophagus ovinus* Linn., × 7.
FIG. 2—Red-headed Sheep Louse, *Bovicola ovis* Linn., × 23.
FIG. 3—Foot Louse, *Linognathus pedalis* Osborn, × 23.
FIG. 4—Scrub Tick, *Ixodes holocyclus* Neumann (Male), × 5.
FIG. 5—Scrub Tick, *Ixodes holocyclus* Neumann (Female), × 5.

fused thorax and abdomen, while the ked has only six legs and a distinct head, thorax, and abdomen. This parasite belongs to the Dipterous family Hippoboscidæ, members of which, generally known as spider or louse flies, occur on a great variety of animals, especially birds. In colour the ked is reddish or grey-brown, and may measure up to one-quarter of an inch in length (Plate 136, fig. 1). The head is small and sunk into the thorax. The abdomen is comparatively large, especially when the insect has just fed. The mouth parts are constructed for piercing and sucking, and the insect lives on blood. It is capable of moving fairly rapidly among the wool, and its movements forwards and sideways are distinctly crab-like. Keds appear to be most numerous among the wool of the neck, breast, shoulders, belly, and thighs.

Life History.

The female sheep tick is curious in that instead of an egg it lays a fully-matured larva, which is enclosed in a soft white membrane. This is, strictly speaking, a pupa, but is commonly known as the "egg." The true egg, however, is retained within the body of the female and hatches there. Seven to ten days after the egg hatches the pupa is laid and is attached to the wool by a glue-like substance. In about twelve hours the white membrane hardens and turns brown. After a period varying from nineteen to twenty-four days, depending upon the season of the year, the adult fly emerges from the pupa. In thirteen to twenty-three days after emergence the female lays her first pupa. The life cycle is, therefore, egg and larval stage within the female insect, seven to ten days; pupal period nineteen to twenty-four days; and laying of first pupa thirteen to twenty-three days after emergence. The female deposits her pupæ, for a while at least, at the rate of one every nine days, but the total number she is capable of laying is not known.

Control.

Like the lice, the ked spends the whole of its life upon the sheep, and is incapable of breeding elsewhere as is frequently thought. The adult insect, however, has been known to live as long as eighteen days when detached from the sheep, though usually the survival period rarely extends beyond four or five days. The pupæ have been known to remain viable for as long as forty-six days in tags of wool which have become removed from the sheep by biting and scratching. Here again, as in the case of lice, sheep may become infested in two ways—either by direct contact with infested sheep, which no doubt is the chief method of spread, or from yards, sheds, and paddocks which have housed infested sheep. In order, therefore, to make sure that such yards, sheds, and paddocks are clean, it would be necessary to spell them during the warmer months for a period of about two months. During the winter, however, if the temperature drops to freezing at any period during the day or night, adult ticks will not survive longer than about five days, and as pupæ are readily killed by frosts, such infested yards, &c., need not be spelled longer than a week. Shearing-shed sanitation is again stressed.

In order to get the best results from dipping, it is necessary to dip twice. The second dipping is required as, although the first dipping will probably kill all the adult ticks, many of the pupæ will survive and form a nucleus of reinfestation. The second dipping is recommended twenty-one to twenty-five days after the first.

THE SCRUB TICK.

Three species of ticks have been recorded as attacking sheep in Queensland—namely, the cattle tick, *Boophilus microplus;* the brown dog tick, *Rhipicephalus sanguineus;* and the scrub tick, *Ixodes holocyclus.* Of these the scrub tick (Plate 136, figs. 4 and 5) is the only one of importance, and at times may be responsible for heavy losses among flocks in ticky areas. *Ixodes holocyclus* is confined practically to the scrubs of the eastern coast, and not only is it regarded as a serious pest of sheep in these areas, but may also cause fatalities among dogs, cats, foals, calves, and even man. On sheep it is usually to be found on those parts of the body not covered by wool, but when very numerous may be located anywhere on the skin surface.

Life History.

The natural hosts of this tick are the native marsupials which are to be found in the scrubs. The tick is known as a three-host tick, which means that it drops from the host in order to undergo the moults which terminate one stage in the life cycle and commence another, reattaching itself to another host at the completion of the moult. The female when replete drops from the host on which she has been feeding, and after a period of about eleven to twenty days commences to lay her eggs, as many as 2,500 eggs being deposited. In warm weather the eggs hatch in from forty-nine to sixty-one days. The tiny larva or seed tick which emerges has only six legs (adults have eight), and, after remaining quiescent for about seven days, attaches itself to the first suitable animal that comes along and commences to feed. In four to six days the larva is fully fed, drops from the host, and seeks some sheltered spot, remaining there for nineteen to forty-one days, when it moults, and this time the first eight-legged stage appears—the nymph. The nymph in its turn attaches itself to another animal, and after feeding for four to seven days, drops to the ground and moults again at the end of another twenty-one to seventy-one days. This time the moult produces the adult tick, which in another seven days commences seeking for the final host.

Injury.

The danger of scrub tick attack lies in the possibility of the inducement of a condition of paralysis. Such a condition is produced by the mature female tick and possibly also by the nymph, and apparently requires at least five days of attachment. The actual cause of this paralysis is unknown, but it is thought to be due to a toxin which is secreted in the salivary glands. Recovery may be possible providing the condition is not too far advanced and the ticks removed, but, generally speaking, once paralysis becomes evident the animal dies.

Control.

Scrub ticks appear to be abundant mainly during the spring months, and during these months short-interval dippings may be found advantageous when small flocks are concerned. The clearing of all scrub as far as practicable and the elimination of the marsupial hosts from the areas grazed by sheep is one of the first steps in the control of this tick.

Dipping.

Several good proprietary dips are on the market, the arsenical dips giving the best results. Sheep should be dipped as soon as they have

recovered from the shock and knocking about of shearing, and when the wool is long enough to hold the dip—say, about four to six weeks off shears. Since lice, keds, and ticks live on the skin surface and in the fleece, the infested animals need not be held in the dip longer than is necessary to wet the fleece and exposed surfaces. About one minute in the dip is usually considered long enough to wet the animals thoroughly. The heads of all the sheep should be pushed or ducked under the surface long enough to ensure complete wetting. Sheep should not be rushed through the dip.

The number of gallons required to charge a dip may be computed in the following manner:—Add together the length at the dip line and the length of the bottom and divide by two. This gives the average length. Obtain the average width in the same manner, and multiply the average length by the average width in inches and the product by the depth. Divide this by 231, and the result will be the approximate number of gallons required. As each sheep when freshly shorn will carry out about 2 quarts of dip, the quantity carried out and retained by the animals plus the quantity required to charge the dip will be a fair estimate of the total quantity of dip required.

Adverse conditions at the time of dipping can and do have a detrimental effect on the result. These are, however, sometimes beyond control, but by using a dip of unvarying and guaranteed consistency, good results will be obtained. The care and condition of sheep before and after dipping are matters which should not be overlooked.

Sheep should not be dipped during extremes of heat and cold, when thirsty, or when in a heated state from driving. They should be yarded overnight and dipped early next day, so that they may have abundant time to dry before nightfall. When ewes and sucking lambs have been dipped, the lambs should be kept apart for some time after dipping. Dipping on cloudy days is not advisable, as the sheep take a long time to dry and are exposed to the risk of rain, which would decrease the efficacy of the treatment to a large extent.

In conclusion, it may be pointed out that failure to maintain a flock free from external parasites in spite of regular dippings and spelling of yards, &c., may be due to (1) carelessness in mixing the dip; each maker supplies certain instructions with his dip which should be followed implicitly; (2) rushing the sheep through the dip so that each animal fails to get thoroughly wet; (3) failure to make a complete muster; (4) failure to ascertain whether sheep bought between dippings and mixed with the flock are clean or otherwise; and (5) the admission of strangers among the flock through broken boundary fences, &c.

Dip Formula.

Arsenic	2 lb.
Sodium carbonate (washing soda) ..	2 lb.
Water	100 gallons.

THE SHEEP BLOWFLIES.

Blowflies are generally regarded as species of flies which blow or lay their eggs on carrion, so, in the ordinary course of nature, acting as scavengers, and helping in this way to get rid of offensive materials in a rapid and efficient manner. Some of the species, however, have

developed the habit of utilising live flesh for this purpose. In the case of short-haired animals, such as cattle and horses, blowfly attack occurs only when wounds and abrasions are present to attract them; but in sheep, on the other hand, the soiling of the thick wool is in itself sufficient to attract the flies and induce "blowing." Wounds, of course, also play their part in the inducement of strike, the infestation of the flesh-cracks and bruises on the head of the ram caused through fighting, and of the tail of the lamb after marking, furnishing good examples.

The conditions predisposing sheep to blowfly attack are as yet imperfectly understood, but it is fairly evident that, before blowing will occur, the wool attracting the flies must have a certain degree of moistness. The crutch and pizzle wool, where fly attack is usually most general, is made attractive to the flies through soiling with excreta and urine. Wool made moist from dew and rain, and even from the saliva of the sheep when it has been biting at some irritation, may also be struck.

The Species of Blowflies Concerned.

In Australia twelve species of blowflies are recorded as attacking sheep, but only some of these are of importance in Queensland. These sheep blowflies belong to the super-family Muscoidea. *Sarcophaga froggatti* Taylor is a member of the sub-family Sarcophagidæ, or flesh flies, the majority of which breed in carrion, though some species infest excreta, and one is a useful parasite of grasshoppers. The Sarcophagidæ may be readily recognised by their striped thorax and checkered abdomen. *Sarcophaga froggatti* was originally obtained from wool-infesting maggots at Winton. A second species of sheep blowfly to be found in Queensland is known as *Peronia rostrata* R.D. This is a shining dark-blue fly belonging to the family Anthomyidæ. Flies of this family also breed in excreta and decaying vegetable matter. Little is known of the biology of *Peronia rostrata*, but it appears to have been bred only from sheep on which "blowing" was well advanced.

The remaining species belong to the sub-family Calliphorinæ, family Muscidæ, a family of flies of widely divergent habits, including, besides blowflies, such species as the house fly, stable fly, and buffalo fly. The Calliphorinæ are to be found breeding mainly in flesh. The six species of this sub-family attacking sheep in Queensland are *Lucilia cuprina* Weid., *Calliphora auger* Fabr., *Calliphora stygia* Fabr., *Chrysomyia rufifacies* Macq., *Chrysomyia micropogon* Bigot, and *Microcalliphora varipes* Macq.

Lucilia cuprina Weid.—This is a comparatively slender and bristly fly (Plate 137, fig. 4), about four-tenths of an inch in length. There is a fair amount of variation in size, which appears dependent upon the amount of food consumed by the larva or maggot. The colour is usually a bright metallic green, but varies to a certain extent, and at times may be almost uniformly bronzy, but it always shows a tinge of green and a characteristic metallic lustre.*

* There are two species of Lucilia concerned in strike—namely, *L. sericata* and *L. cuprina,* both of which were previously included under the one name, *L. sericata. L. cuprina* is the more important of these two species in Queensland, as *L. sericata* does not appear to extend further north than about Brisbane, and is unknown in the West. Both are introduced flies.

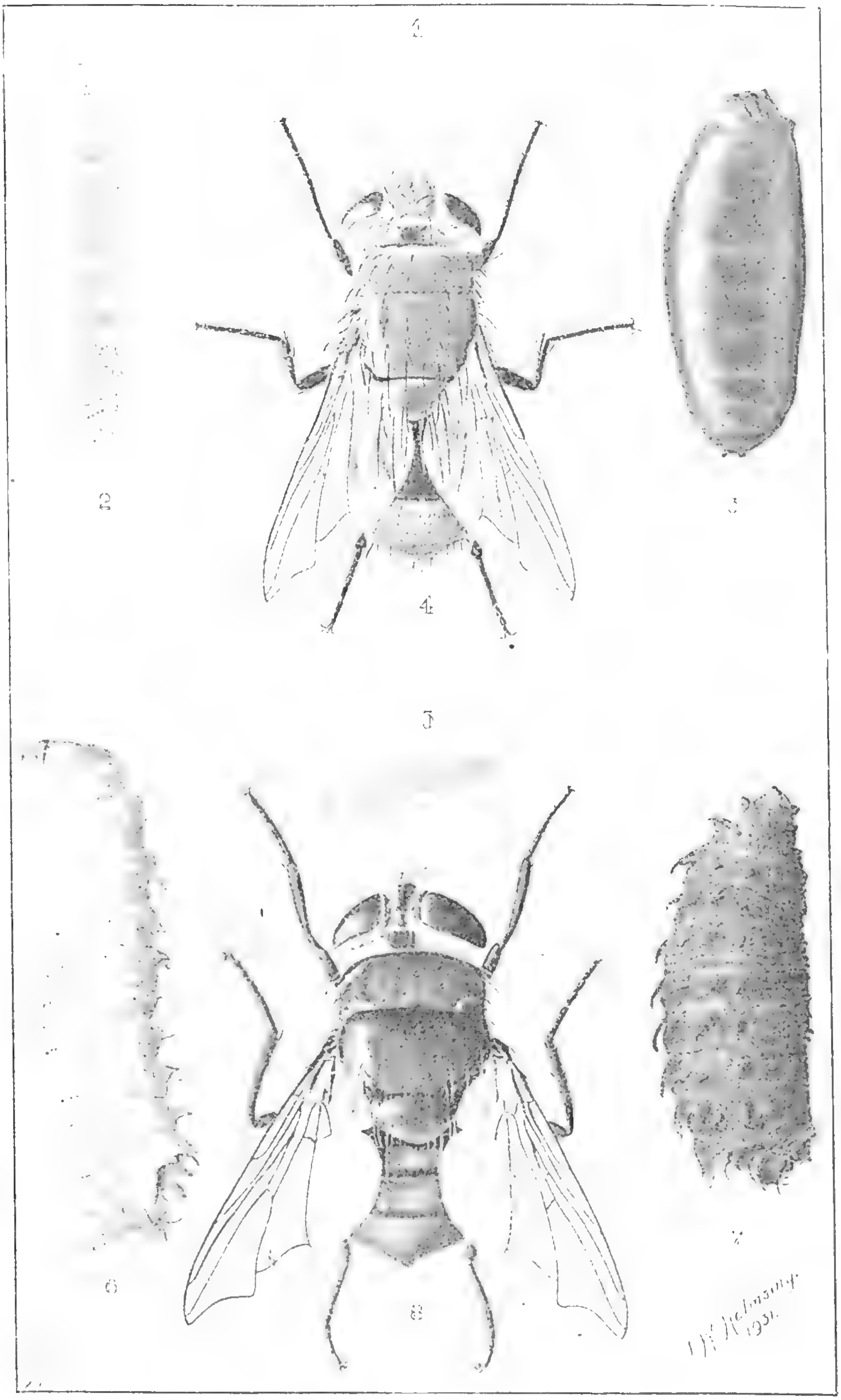

PLATE 137.—SHEEP MAGGOT FLIES.
(*For description of Plate see page 345.*)

Calliphora auger Fabr.—This is the smaller yellow blowfly which frequently comes into the house to blow meat. It may be readily recognised by the blue abdomen, deeply blotched on either side of the basal segments with yellow, so that the middle and apical portions of the abdomen are blue. The blue on the apical segments is somewhat obscured by a pale-yellow dust. The thorax is blue-grey, and the legs reddish-brown. This fly is a rather stout species measuring about one-third of an inch long.

Calliphora stygia Fabr.—This species is the larger yellow-bodied blowfly, which, like *C. auger*, frequents houses, and attracts attention by its persistent buzzing and boisterous flight. The insect is somewhat variable in size, but well-developed specimens may measure up to half an inch in length. The thorax is bluish-grey with a lighter under-surface, and yellow legs. The abdomen is greenish tinted, dusted with yellow, the whole of the upper surface clothed with short black hairs. The and yellow legs. The abdomen is greenish tinted, dusted with yellow, of the abdomen, give the fly a distinctly golden appearance. At least eight distinct species—all very similar in appearance to *C. stygia*—have been recognised, of which the Western Australian *C. australis* is one.

Chrysomyia rufifacies Macq.—This species is a comparatively robust fly (Plate 137, fig. 8), measuring about one-third of an inch in length. The colour is a uniform metallic blue, sometimes with a tinge of green, and sometimes bronzy like *Lucilia cuprina*. The colour is deeper on the edges of the abdominal segments to give the fly a distinctly banded appearance. If examined closely, very few bristles will be detected. *C. rufifacies* at times bears a strong resemblance to *Lucilia cuprina*, but may be readily recognised by its more robust appearance, prevailing bluish colour, the presence of the narrow bands across the abdomen, and the comparative lack of bristles. Both of these species may at times be confused with the greenish fly (*Pseudopyrellia* sp.) so frequently seen in large numbers around fresh cow dung. This species is not a blowfly, and its green colour soon turns to a bright blue-violet after death, while the colours of the two blowflies remain constant.

Chrysomyia micropogon Bigot.—In size *C. micropogon* approaches that of the smaller house blowfly, *C. auger*. It may be readily recognised by its large reddish-brown eyes, yellow face, uniform metallic dark-blue colour, and black legs.

Microcalliphora varipes Macq.—This is the smallest species of the blowflies infesting sheep, being about half the size of the house fly and

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SHEEP MAGGOT FLIES.

Description of Plate 137.

Lucilia cuprina Weid.

Fig. 1	.. ..	Egg x 23.
Fig. 2	.. ..	Larva x 7.
Fig. 3	.. ..	Puparium x 7.
Fig. 4	.. ..	Adult x 7.

Chrysomyia rufifacies Macq.

Fig. 5	.. ..	Egg x 23.
Fig. 6	.. ..	Larva x 7.
Fig. 7	.. ..	Puparium x 7.
Fig. 8	.. ..	Adult x 7.

somewhat more robust, due to its comparatively large head. Its colour is bright metallic green, with a pale-yellow face and mottled legs.

Life History Notes.

There seems to be no distinct strain of flies that attack sheep, for such flies that attack sheep will readily lay their eggs on meat, and, on the other hand, flies that have been reared on meat will oviposit on the wool of sheep. The period of development of the eggs and larvæ on the sheep is much the same as that in meat, and such of the life histories of Queensland sheep blowflies as are known have been for the most part obtained by rearing the larvæ in meat.

The life histories of the several species are very similar, differing only in detail. It is, therefore, proposed to deal thoroughly with the life history of only one species—*Lucilia cuprina*—mentioning that of the others only by way of comparison. This fly has been chosen, as it is probably the most important sheep blowfly, and has received a good deal of attention from various workers.

The Egg.

The female fly lays her eggs in some sheltered spot in the meat or in the wool. As many as 250 eggs (which are heaped together in a sticky mass) may be laid at one time. A single female, during her lifetime, may lay 1,000 eggs or more. The newly-laid egg (Plate 137, fig. 1) is white in colour, and somewhat sausage-shaped. In some of the species—*Calliphora auger* and *Calliphora stygia*—the egg at times is retained in the body of the female until it hatches, and is then deposited as a tiny maggot. In summer time the eggs may hatch within sixteen hours, but in midwinter may take as long as three days, or even more in a very cold climate.

The Larva.

From the egg comes the tiny, legless maggot of the fly. The maggot (Plate 137, fig. 2) is of an elongate conical shape, pointed at the anterior end and divided into a number of segments. The maggots of the majority of blowflies are smooth in appearance and whitish in colour, but those of *Chrysomyia rufifacies* (Plate 137, fig. 6) and *Microcalliphora varipes* are brown and so covered with erect tubercles as to give them a hairy appearance. In feeding, a slimy fluid is emitted from the mouth, and the wet and soiled appearance of infested wool is partly due to this fluid, which rots the wool fibres. They feed in squirming masses with the pointed head end immersed in the liquefied meat and their blunt hind ends raised above the surface. At this end there is a pair of openings, known as spiracles, through which the maggots breathe. The necessity of keeping these spiracles clear of the fluid is evident, else the maggots would perish.

In the warmer months the maggots feed rapidly, and are fully fed in four days. In the winter time they feed much more slowly, and may not be fully fed for seven days or more.

The Prepupa and Pupa.

When fully fed, the maggot crawls away from the meat or drops from the sheep, burrowing into the earth to seek protection from birds and parasites. Here it lies motionless for about two days in summer or for twenty-two days or more in winter, preparing for the commencement

of the great change in its life, from which it will emerge as the adult fly. This quiescent period is known as the prepupal or larval resting period. Gradually the maggot shrinks and its outer skin becomes hardened and turns brown. Inside this hard brown coat or puparium (Plate 137, fig. 3) the whole of the larval tissues break down into a creamy mass, from which the adult structures—the body, legs, and wings—are rebuilt. This is the pupal stage, and may last only six days in summer or as long as seventeen days or more in winter.

Duration of Life Cycle.

From the foregoing it will be seen that in summer time the life cycle of *Lucilia cuprina* may be completed in thirteen days and in winter in forty-nine days or more. For *Chrysomyia rufifacies* and *Microcalliphora varipes* the respective periods are nine and thirty-six days, and *Calliphora auger* seventeen and thirty-three days. The life-cycle periods of the remaining species are incomplete, but summer conditions are said to induce the emergence of the adult *Sarcophaga froggatti* in twenty-two days, and of *Chrysomyia micropogon* in twelve days. In the spring *Calliphora stygia* takes about thirty days for its life cycle, and *Peronia rostrata* twenty-six to forty-three days.

The life-cycle periods given above were obtained in Brisbane. It is probable that the western climate of Queensland would be conducive to a good deal of variation in the respective periods, especially in the winter, when the life cycle may extend over a period of several months.

The Adult.

The imprisoned fly, when ready to emerge from the pupa, is able, by means of a pulsating bladder-like organ on the front of its head, to push off the end of the puparium or hard pupal case and work its way to the surface of the soil.

On emerging the fly is very soft and drab in colour. It makes its way to some sunny spot, where it spreads its wings and raises them up and down to facilitate drying. After a while the bladder is withdrawn into the head, the body and wings dry, the colours of the body become evident, and the insect (Plate 137, fig. 4) is ready to fly off and commence its adult life.

Little has been published of the biology of the adult flies, but certain data concerning their range of flight and longevity is available.

It has been shown that the range of flight of the blowfly *Chrysomyia rufifacies* is at least 10 miles, which can be traversed in about twelve days. This means that flies breeding in a carcase may be distributed over a tract of country 20 miles in diameter—an area of 314 square miles. The flight of the flies is usually with or slightly across the wind, but carrion may be followed against a slight breeze.

The length of life of the adult or fly stage of *Chrysomyia rufifacies* in the field has been determined as at least twenty-eight days. Under conditions of captivity, *Lucilia sericata,* which is very similar to *Lucilia cuprina,* has been kept alive for seventy-seven to ninety-one days.

Why " Strike " in Sheep Occurs.

Various theories have been advanced to explain blowfly infestation of sheep, but the modern viewpoint indicates two factors as being mainly

concerned. First of all, although there are several species of blowflies which attack the sheep, many of these may be present without "strike" being evident. Observations have shown that the sheep blowflies may be divided into two groups mainly according to the manner in which they react to carrion. If an animal dies certain species are immediately attracted to the carcase and lay their eggs. These flies are induced to oviposit only while the flesh remains comparatively fresh. Once it has reached a certain stage of decay it is no longer attractive to them. After the maggots of these flies have been at work for some time the carcase is then rendered suitable for oviposition by other species of flies. Thus the carrion-feeding blowflies become divided into *primary* and *secondary* flies, the primary flies including those species which visit the carcase first and are only attracted while the flesh remains comparatively fresh. Moreover, infestation of carrion by the maggots of the primary flies is considered to be necessary before the secondary flies can be induced to oviposit. That is, the primary flies' maggots, in some way or other, render the carrion suitable as food for the maggots of the secondary flies. In the total absence of these primary flies the carrion may not be infested with blowfly maggots to any marked extent, and may simply dry up. *Lucilia cuprina* and the two species of *Calliphora* are primary flies, whilst *Chrysomyia rufifacies* and *Microcalliphora varipes* are secondary flies.

In the case of blowing of sheep these two groups of flies play a similar part to that enacted with carrion. Strike is initiated usually only by the species of *Lucilia* and *Calliphora*, and previous infestation with the maggots of these flies is necessary before the hairy maggots of *Chrysomyia rufifacies* and *Microcalliphora* are seen. The position with regard to *Chrysomyia micropogon* is not known to any degree of certainty. It is believed that this fly is secondary to a certain extent, but that in the presence of wounds and abrasions which have reached a certain stage of decay its maggots are able to exist without the previous presence of maggots of the primary flies. In most cases, however, strike can be initiated only by the primary flies, and in their absence very little blowing of sheep would be evident.

The second factor necessary to induce strike is that not only is the presence of a species of one of the primary blowflies required, but the sheep must be attractive to the flies to an extent sufficient to induce them to lay their eggs. The parts of the body most favourable to the flies, not taking into account the presence of wounds, are the crutch and adjacent areas in ewes, around the pizzle in wethers and rams, and occasionally the shoulders and other parts of the body which, under certain conditions, are kept moist. It is now considered that this attractiveness to the flies is associated with bacteria which are present in the fleece and on the skin surface, and which under certain conditions, of which the presence of moisture is probably the most important, increase and render the sheep attractive to the flies. Heavily-wrinkled sheep are especially attractive, for the body folds, by retaining the body secretions and any moisture, are areas in which these bacteria develop and increase very rapidly. Strike on portions of the body such as the shoulders and back are associated with a condition of the fleece known as "water rot," which is caused by certain bacteria in the presence of constant dampness.

Control of Sheep Blowflies.

Trapping and carcase treatment have in the past been given greatest prominence as measures to be adopted for blowfly control.

Trapping.—To be successful the majority of flies caught by trapping should be primary flies. Unfortunately, however, most of the flies trapped are secondary, due to the fact that primary flies are only attracted to the bait whilst it remains comparatively fresh. Little result can therefore be expected from trapping unless a bait can be discovered which will remain attractive to the primary flies over a comparatively long period.

Carcase Treatment.—Carcase treatment is necessary from a sanitation standpoint, but it is questionable whether it has any influence towards the control of strike. Some slight control by carcase treatment may be expected only if the carcase is treated within about three to four days of death. This would kill the maggots of the primary flies breeding there, but if the treatment is delayed any longer than about three or four days these maggots will no longer be present, and those destroyed will be the progeny of the secondary flies; in which case such delayed treatment may do more harm than good so far as the control of strike is concerned. It has already been pointed out that the primary flies visit the carcase first and their maggots are at work shortly after death. The carcase is then invaded by the secondary flies whose maggots not only render the flesh unsuitable for the primary fly maggots, but, being more robust, are more successful in the competition for the available food. As a result a good percentage of the primary fly maggots are driven from the carcase and die. Thus it will be seen that these secondary flies act as a control on the numbers of primary flies, and a wholesale destruction of their maggots might possibly result in an increase in the numbers of the primary flies upon which initiation of strike depends to a large extent.

Carcases are best treated by burning or by the careful application of a poison dip powder containing arsenic to all portions. The part of the carcase in contact with the ground must receive special attention.

Jetting.—Jetting will give immunity from "strike" for a period of four to six weeks. The following formula was found by the Department of Agriculture, New South Wales, to be more satisfactory than any other that was used:—

White arsenic	10 lb.
Stone lime	10 lb.
Caustic soda	1 lb.
Water	100 gallons.

The pressure used should not exceed 150 lb. to the square inch, otherwise the skin may be injured.

Dressings.—There is no dressing yet known which may be regarded as entirely satisfactory, but the following are recommended:—

(1) ½-1 oz. Paris green, 6-8 oz. Kaolin, 18 oz. soft soap solution (·5 per cent. strength).

(2) Five per cent. watery solution of zinc sulphate.

(3) Four per cent. phenol crystals in whale oil.

(4) Five per cent. watery solution of Monsol.

INTERNAL PARASITES.

The internal parasites of the sheep comprise tapeworms, a fluke, several species of roundworms, and one other form, the nasal fly.

THE SHEEP NASAL FLY (*Oestrus ovis* L.) (Fig. 1 (a) and (b)).

Description and Life History.

The adult sheep nasal fly (fig. 1 (*a*)) is a squat greyish fly which appears during the spring and summer months. The fly deposits a tiny grub on the edges of the nostril which makes its way up the nostril and sometimes into the communicating cavities. The presence of the fly often causes the sheep to become frantic in their efforts to prevent the fly attacking them, and they generally hold the nose against the ground or some other sheep when the fly is about.

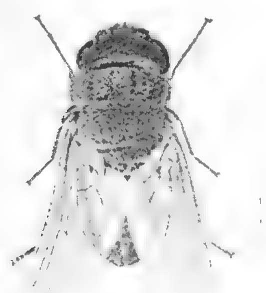


FIG. 1 (*a*).

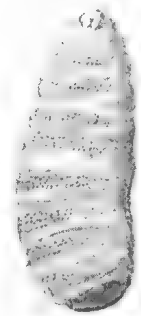


FIG. 1 (*b*).

PLATE 138.

The larvæ or grubs (fig. 1 (*b*)) are provided with a strong pair of mouth hooks and the body is encircled with rows of spines. By means of these mouth hooks the larva maintains its position in the nostrils feeding upon the discharges its presence occasions. When fully grown the larva measures up to four-fifths of an inch in length, and is yellowish in colour with black bands on the dorsal surface. It then leaves the nostril, usually being sneezed out by the sheep, and upon reaching the ground burrows below the surface and pupates. The outer skin hardens, becomes leathery, and turns black. From the pupa the adult fly eventually emerges.

Effect on the Sheep.

The presence of the grubs in the nostril produces an irritation resulting in a discharge which becomes thickened and discoloured, presenting the condition known as "snotty nose." The animal frequently sneezes and in heavy infestations its breathing may be seriously interfered with. The eyes may become inflamed and the sheep may continually move its head about as though endeavouring to rid itself of the obstructions in the nostrils. The appetite is impaired and the animal may lose condition. Death due to nasal fly is not very common, but the grubs have been seen in the brain.

Control.

Treatment is not very satisfactory and control depends almost entirely on preventive measures. The best of these consists in boring small holes about 2 inches in diameter in the bottom of the salt troughs. Salt is placed in these holes, the edges being heavily tarred with pine or Stockholm tar so that the sheep get the tar on their nostrils as they lick the salt. The tar acts as a repellent and prevents the fly depositing larvæ in the nostrils.

TAPEWORMS.

Two larval tapeworms occur in the sheep—the bladder worm, *Cysticercus tenuicollis*, and the hydatid worm, *Echinococcus granulosus*. *Cysticercus tenuicollis* is the bladder worm so frequently encountered in the body cavity of the sheep. It is sometimes also seen in the liver. The adult tapeworm, known as *Taenia hydatigena*, occurs in the dog, which becomes infested only when it eats a portion of the sheep containing a bladder worm.

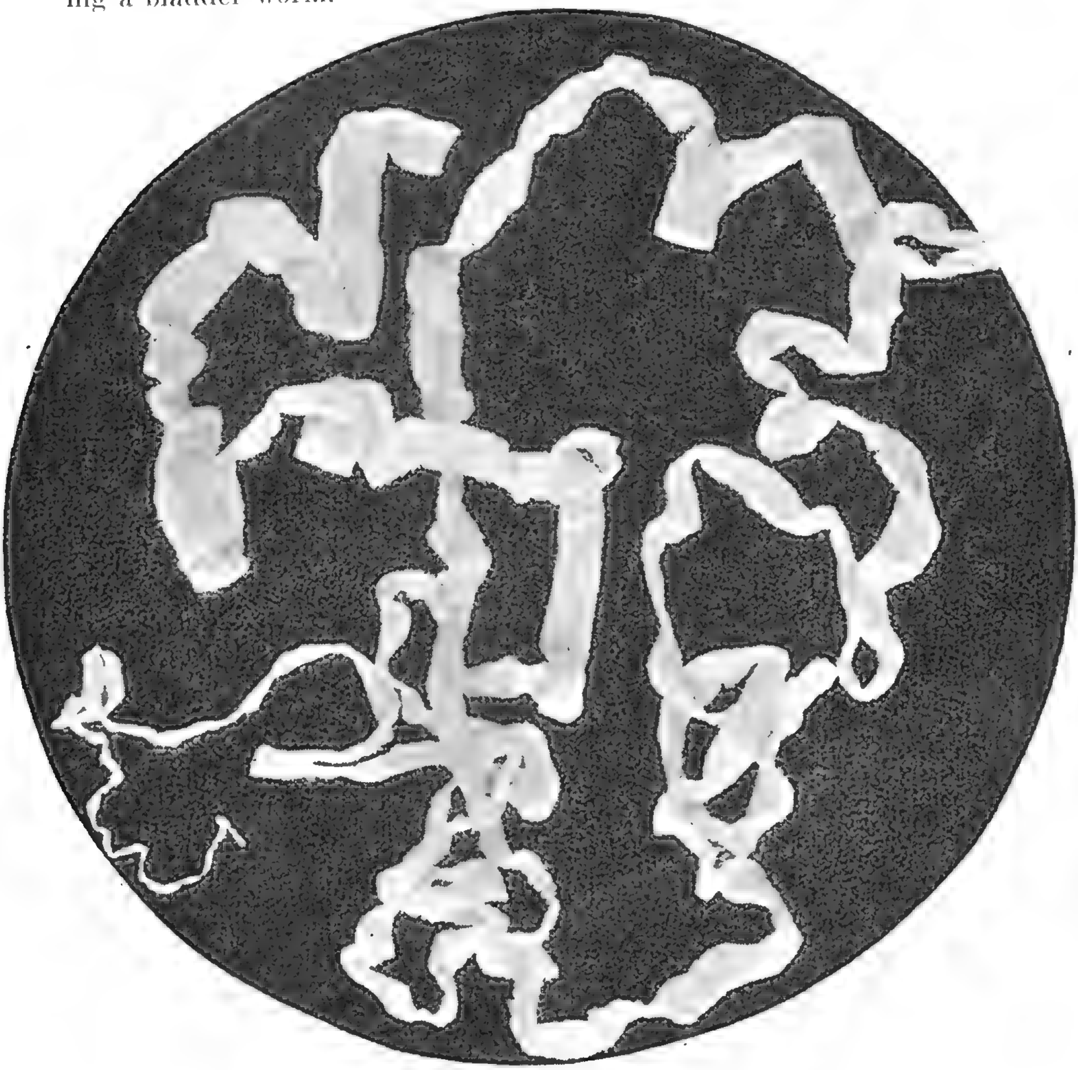


Plate 139.

Fig. 2. Tapeworm (*Moniezia expansa*). Natural size.

The hydatid larva, *Echinococcus granulosus,* is usually found in the liver and lungs. The adult tapeworm also occurs in the dog, the life history being similar to that of *Taenia hydatigena.*

Of these two larval tapeworms, the most important is the hydatid worm, as it may also occur in man. Prevention consists in not feeding raw offal to dogs, as this may contain the larval forms. Dogs should also be kept as free of the adult tapeworms as possible by treatment with an efficient drug.

Adult tapeworms are found in the small intestine of the sheep, more especially in lambs. Two species are known to occur in Queensland—*Moniezia expansa* (Fig. 2), which is very common, and *Halictometra giardi,* which is much less frequently seen. Both these species are whitish to yellowish in colour and may attain a length of many feet, *Moniezia expansa* (fig. 2), which is very common, and *Halictometra* of both these species are unknown, and preventive measures cannot therefore be outlined. Lambs infested with tapeworms become unthrifty, weak, and emaciated, diarrhœa being frequently manifested. Diagnosis is readily made by examining the fæces in which tapeworm segments will be seen.

Treatment consists in starving overnight, and next morning each lamb is given 1 to $1\frac{1}{2}$ fluid ounces of the following formula:—

White arsenic (containing not less than 95 per cent. arsenious acid)	2 oz.
Epsom salts	6 lb.
Water	5 gals.

Boil the arsenic for half an hour in two gallons of water; allow to cool and sediment. Pour off and retain the clear liquid; add the Epsom salts, and make up to 5 gallons.

FLUKE.

Only one species of fluke occurs in the sheep in Australia—namely, the liver fluke, *Fasciola hepatica.* This parasite is found in the bile

PLATE 140.
FIG. 3. THE LIVER FLUKE (*Fasciola hepatica*). Natural size.

ducts of the liver, and in the Southern States is a serious parasite. Although it is found in one or two districts in Queensland, it is only of minor importance in this State.

THE LARGE STOMACH WORM.

PLATE 141.
FIG. 4. THE LARGE STOMACH WORM (*Haemonchus contortus*). Natural size.

Description.

This worm is found in the fourth stomach, and is undoubtedly the most serious parasite the Queensland sheepman has to contend with. The appearance of the parasite is very distinctive, as the female is spirally striped, resembling in general a barber's pole. The male is smaller and uniformly whitish or pinkish.

Life History.

The eggs laid by the female worms pass out in the dung, and under favourable conditions of temperature and moisture hatch in a few hours. The young larva, on emerging from the egg, feeds in the dung, and during its development casts its skin twice. After the second moult, however, the cast skin remains as a closely-fitting sheath and assists in protecting the larva against such adverse conditions as dryness. This ensheathed larva is the infective stage, and it is only by swallowing the ensheathed larva that the sheep can become infested. When the grass is wet with dew or rain this larva crawls up the grass blades and is eventually consumed by the sheep as it grazes. In the fourth stomach the tiny worms grow rapidly, and after about four weeks are fully mature and laying eggs.

Effect on the Sheep.

Stomach worm infestation is serious, and if left untreated, heavy mortalities may occur. Such symptoms as periodic scouring, bleaching of the skin and mucous membranes of the eyes and mouth, bottle jaw, tucked-up flanks, and a rapid loss of condition accompany infestation with this round worm. Stomach worm is most serious among lambs, especially weaners, and lambing ewes.

Treatment and Control.

For the removal of the large stomach worm, carbon tetrachloride or bluestone is highly efficient. Carbon tetrachloride is given in doses of 2 cubic centimetres for adults and 1 cubic centimetre for lambs in 3 and 4 cubic centimetres respectively of liquid paraffin. This drug is regarded as being more efficient than bluestone, and much easier to administer, as the dose is very small and does not require, moreover, previous starvation. In certain classes of country and under certain conditions not yet quite understood, however, sheep may not tolerate this drug, and even a very small dose may have serious and even fatal results. It is essential, therefore, that where carbon tetrachloride has never previously been used, that only a few sheep be treated at first and the effects of its use carefully noted. Frequently this intolerance is due to a calcium deficiency, and sheep running on country deficient in this element should be given a calcium lick for some time before treatment.

On the whole, bluestone may be regarded as a safer drench than carbon tetrachloride, though not so effective nor so easy to administer. It may be given alone or with an equal quantity of mustard. The addition of the mustard is considered to increase the efficiency of the treatment, but at the same time, it must be pointed out, considerably adds to the cost as well. Starvation overnight is necessary, and should be continued for about four hours after drenching. Only fresh (blue) bluestone should be used, and any white powdery material should be discarded. The bluestone should be mixed in an enamel or earthenware vessel, so that it cannot react with a metal surface, which would decrease its effectiveness.

Formula.

Bluestone	1 lb.
(Mustard)	(1 lb.)
Water	5 gals.

Dose.

Adults	2 fluid oz.
Lambs	1 fluid oz.

On holdings which are heavily infested, only treatment at regular intervals will hold the worms in check. During the summer months, treatment at monthly intervals is essential, especially towards the autumn. At least one drench is desirable about midwinter and another at the end of the winter, about September.

As the lambs and lambing ewes are usually most seriously affected by infestation, any control measures that are considered practicable should especially concern these two classes of sheep.

Marshy areas and other low-lying paddocks should, if possible, be used for the older sheep, wethers and aged ewes.

Burning-off the pastures will destroy a big percentage of the free living stages in the grass. Such burnt-off paddocks are comparatively safe for young sheep which, however, should be drenched before being placed there. It is a good idea to reserve such a paddock for the use of the weaners only, which, of course, must be drenched just before they are taken from the ewes. Heavy stocking makes stomach worm control very difficult, and on heavily infested holdings it is advisable to go to the other extreme and under-stock until there is some definite degree of

control obtained. In cases where paddocks can be left vacant, no sheep or cattle should be allowed to graze for at least six months, and at the end of this period such paddocks may be considered safe for stocking with clean sheep.

Finally, the provision of suitable licks and, where possible, the top-dressing of pastures, should be given consideration, as the improved health of the sheep resulting from these practices enables it to resist the effects of infestation to a conspicuous extent.

LESSER STOMACH WORM.

PLATE 142.

FIG. 5. THE LESSER STOMACH WORM (*Ostertagia circumcincta*). Natural size.

Besides *Haemonchus contortus,* the fourth stomach may be inhabited by a smaller brownish species, *Ostertagia circumcincta,* which lies just under the mucous lining. This parasite, though fairly common, does not occur in large numbers and is not considered to be of any economic importance in Queensland. The life history is similar to that of the large stomach worm.

SMALL TRICHOSTRONGYLES.

Description.

These are very tiny, hair-like worms, reddish in colour, occurring mainly in the first 15 to 20 feet of the small intestine. Their size makes them easily overlooked, and detection is only possible by a very careful examination of the intestine wall. They may be responsible for serious losses among lambs and are concerned with a diarrhœric condition known as "black scours." Their life history is practically the same as that of the large stomach worm.

Control.

In South Africa these worms are commonly known as "bankrupt worms" and are very aptly named. At present there is no drug which is efficient in removing them, though regular drenching with carbon

tetrachloride or bluestone may have some beneficial effect. These parasites, for the main part, affect only the lambs, and everything possible should be done to prevent the young sheep from becoming infested.

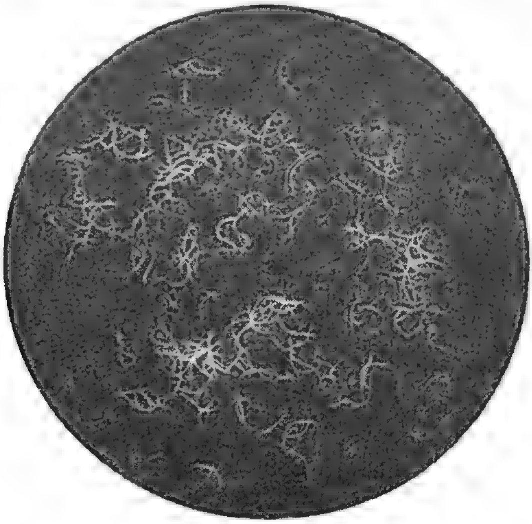


PLATE 143.
FIG. 6. SMALL TRICHOSTRONGYLES (*Trichostrongylus spp.*). Natural size.

The preventive measures recommended for the large stomach worm should be practised. In addition, the use of improved pastures, especially for the lambs, is of the greatest importance if breeding in areas where the small *Trichostrongyles* are present is to be continued.

THE NODULE WORM.

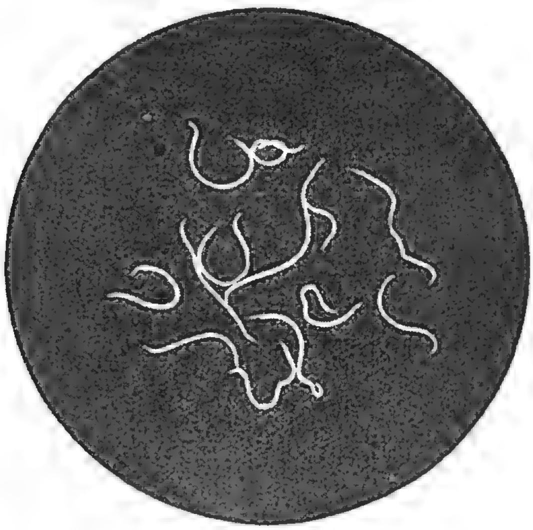


PLATE 144.
FIG. 7. THE NODULE WORM (*Oesophagostomum columbianum*). Natural size.

Description.

Of the species of roundworms that infest the intestinal tract, one of the most important is the nodule worm which is found in the large bowel. The adult worms are whitish in appearance, with the head end bent in the shape of a hook. The females may attain a length of five-eighths of an inch, the males being somewhat smaller.

Life History.

The life history in the dung results, as in the case of the large stomach worm, in an infective ensheathed larva which is taken in by the sheep whilst grazing. The larva eventually reaches the large bowel and burrows into the wall of the intestine. A nodule is formed around the larva, in which it lies for a minimum period of six to eight days. Leaving the nodule, the young worm moves into the lumen of the intestine and develops into an adult. Larvæ can be found only in the very small nodules, which in time increase considerably in size, and become filled with a hard, cheesy, greenish pus.

Effect on the Sheep.

A heavy infestation produces emaciation, general debility, and frequently continuous scouring. Young sheep are more affected, and in country showing nodule worm remain stunted and unthrifty.

Control.

Up to the present no satisfactory treatment for the disease associated with this worm is known, and the preventive measures already discussed for stomach worm are of the greatest importance.

THE WHIPWORM.

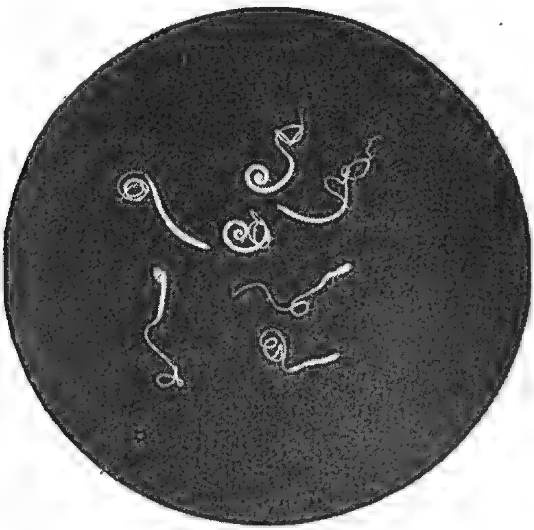


Plate 145.

Fig. 8. The Whip Worm (*Trichuris ovis*). Natural size.

Description.

Whipworms, *Trichuris ovis,* occur in the cæcum or blind gut and in the adjoining portion of the large intestine. The species may be readily recognised by its whip-like appearance, the lash being represented by the long, slender anterior part of the worm, while the thick posterior portion of the body is reminiscent of the whip handle.

Life History.

The eggs passed out in the dung develop into infective embryos, which, on being swallowed by the sheep, hatch and give rise to tiny larvæ. These larvæ make their way to the cæcum, where they grow to maturity.

Effect on the Sheep and Control.

Unless present in very great numbers, which is extremely rare, this species is not associated with any pathogenic condition. No satisfactory treatment is known, and the worms can be controlled only by preventive measures.

LUNGWORMS.

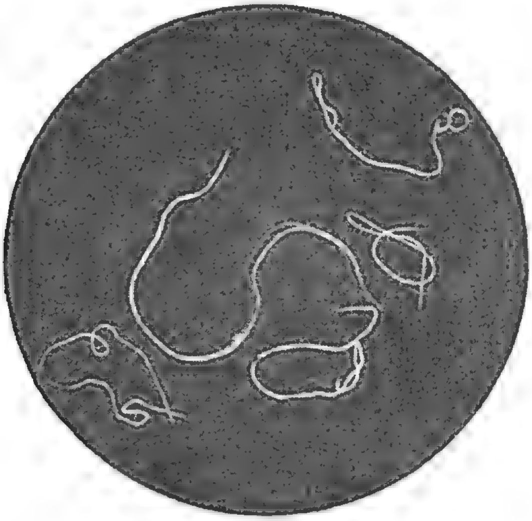


PLATE 146.
FIG. 9. THE LARGE LUNGWORM (*Dictyocaulus filaria*). Natural size.

Description.

There are three species of lungworms infesting sheep, but the only species of any importance in Queensland is the large lungworm, *Dictyocaulus filaria*. These are long whitish worms up to 3 inches or more in length, occurring in the air tubes of the lungs.

Life History.

The eggs, when laid by the female worm, contain a small active larva which hatches either in the lungs or in the alimentary canal. They are passed out mainly in the dung, but may also be coughed up or appear in the nasal secretions. In the open the larvæ, under suitable conditions of temperature and moisture, become infective, and are eventually swallowed by the sheep when grazing or drinking. They eventually reach the lungs either in the blood or lymph stream, settle down in the air tubes, and grow to maturity.

Effect on the Sheep.

A few lungworms do little harm, but when a heavy infestation is present the worms irritate the lung tissue, causing severe inflammation and the production of a frothy mucus. The bunches of worms obstruct the passage of air, and the animals show symptoms of difficult breathing. A frequent husky cough becomes evident, and the infested sheep may rapidly lose condition and die.

Control.

The following recommendations are given for the control of this parasite:—

(1) The greatest sources of infestation are pools of water and low-lying, marshy areas, and these should be avoided as sheep pastures in lungworm areas. In the case of an outbreak, any sheep in pastures of this nature should be immediately removed to a dry, well-drained, and sheltered paddock.

(2) Treatment with carbon tetrachloride or bluestone is advised. This has no effect on the lungworms themselves, but as lungworm and stomach worm infestations usually occur together, this treatment, by removing the stomach worms, increases the sheep's resistance to lungworm.

(3) It has been shown experimentally that infested sheep recover more rapidly by good nursing than by any other attempted treatment. Provide a good, safe water supply in troughing. See that the paddock is well shaded and sheltered, and supplement the grazing of the affected sheep with hand-feeding and suitable licks.

(4) Injection of certain drugs into the windpipe by means of a sterilised hypodermic syringe will give relief. The operation is not an easy one, however, and should be carried out under the supervision of the local stock inspector. The following formula will be found satisfactory, especially if three treatments are given at three-day intervals:—

Oil of turpentine	1 c.c.
Creosote	0·5 c.c.
Olive oil	2 c.c.
Chloroform	0·5 c.c.

A WIRE GATE.

There will be no difficulty in constructing this gate, which is an improvement on the "concertina" type.

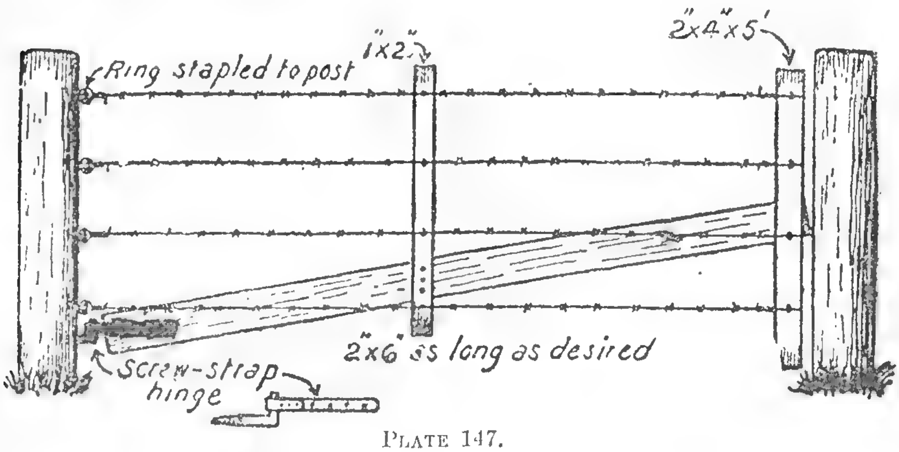


Plate 147.

Queensland Weeds.

By C. T. WHITE, Government Botanist.

NUT GRASS (*Cyperus rotundus*).

Description.—A grass-like plant producing numerous underground runners and tubers. The tubers globose or egg-shaped, mostly about ½-inch long, covered with a dark brown skin. They possess a white or cream-coloured flesh with a rather nutty, somewhat aromatic flavour. Leaves green, 4-6 inches long, the lowermost ones clothing the bottom of the shoot reduced to reddish brown sheathing bracts. Seed heads radiating and branching from the top of a green triangular stem 6 inches to a foot or more high, and subtended by three narrow leaves. Seed heads composed of a number of reddish-brown many-flowered spikelets. Seeds or nutlets chestnut brown, but apparently rarely if ever ripen in Queensland plants.

Distribution.—Nut Grass is a widely spread tropical and subtropical weed, and as it was collected in North Australia by Robert Brown in the very early years of the nineteenth century, it is reasonable to suppose that it is a native of Australia in common with other warm countries.

Botanical Name.—*Cyperus*—origin obscure, perhaps from Cypris, a name of Venus from the edible tubers of some species being supposed to have marked qualities as an aphrodisiac; *rotundus* (Latin) meaning round, referring to the globose tubers.

Properties.—Nut Grass has some value as a fodder and is readily eaten by all classes of stock. Pigs are especially fond of the tubers and on this account the practice of pasturing them on Nut Grass-infested areas is often adopted.

Eradication.—On the whole it may be stated that both in Queensland and in other countries poisonous sprays have proved of little or no value unless several applications are made. Experience has shown, however, that small patches can be eradicated by an application of cheap-grade salt at the rate of ¼ lb. per square foot, either dry or in the form of brine. Waste brine as obtainable from butchers, hide stores, &c., is quite suitable. Heavy applications of this type, however, render the land unfit for cultivation for a season, but the method is excellent for tennis courts, wide garden paths, &c., where the salt can do no harm. The best results are obtainable by applying the salt in hot, dry weather. In small areas one of the best methods of eradication is to keep the green growth constantly cut off, and this on the whole seems better than forking the land over. The Nut Grass tuber is a storehouse of nutriment for the young shoots. The food material stored in the tuber is used in the formation of the young shoots. Cut these off regularly and the tuber will eventually become exhausted. Another point is that the formation of fresh tubers is dependent upon the leaves, and if these are not allowed to grow fresh tubers cannot be formed and the old ones must die of exhaustion.

It has been recommended at odd times that small patches should be covered with galvanised iron or some such material, but this is of no value whatever as the Nut Grass tubers simply remain dormant, and spring into active life as soon as the covering is removed. Pigs and

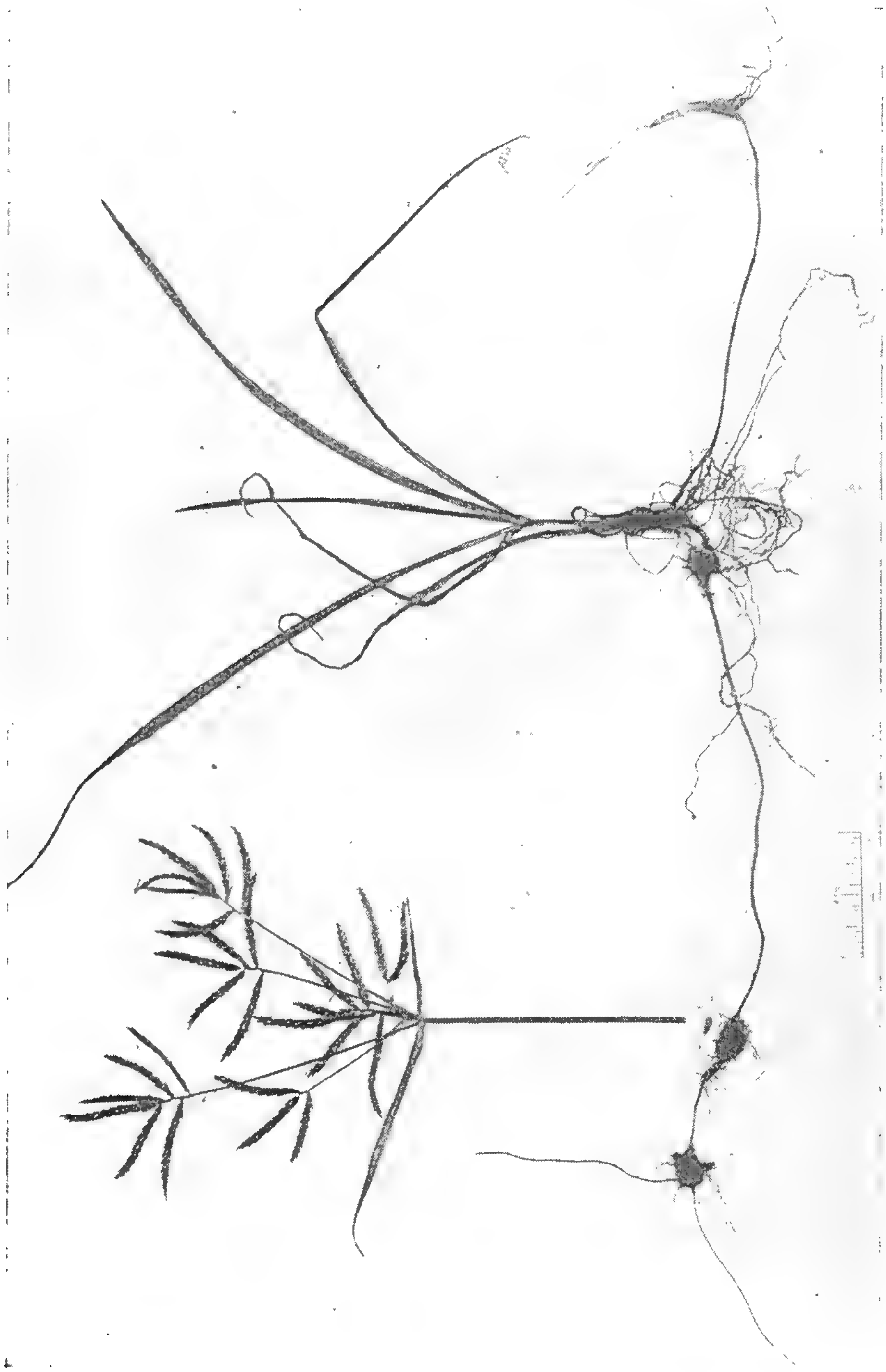


Plate 148. Nut Grass (*Cyperus rotundus*).

poultry, including ducks, do good work in keeping the weed in check in small areas, and in confined places will in a few years completely eradicate it.

A great deal of hope has been raised at times of insects having considerable possibilities in the control of Nut Grass. An article on a Coccid (the family to which the scale insects belong) and a Mealy Bug was published by Mr. W. A. T. Summerville in the "Queensland Agricultural Journal" for October, 1933. After consideration of evidence gathered from time to time and from different localities, it is stated that either insect has little or no value in controlling Nut Grass in such places where Nut Grass would ever become a pest to the farmer.

Botanical Reference.—*Cyperus rotundus* Linnaeus species Plantarum 45, 1753.

SOUR GRASS OR YELLOW GRASS (*Paspalum conjuqatum*).

Description.—An extensively creeping grass covering large areas to the exclusion of other herbage. Leaves mostly about 5 inches long and ½ inch broad. Seed heads usually two at the top of a slender stem and spreading away from one another; very slender, 3-4½ inches long, with the small, rounded, yellow spikelets ("seeds") crowded in two rows on one side of each branch of the two seed heads. Individual spikelets ("seeds") round or slightly depressed on one side, convex on the other, and enclosing a shining, semi-translucent, straw-coloured grain; margins of the spikelet thickened and bearing a few long hairs.

Distribution.—A widely spread grass over the tropical regions of the world; originally described from Dutch Guiana, tropical South America.

Botanical Name.—*Paspalum* from *paspalos,* one of the ancient Greek names for the Millet; *conjugatum* (Latin), meaning coupled or united and relating to the two branches of the seed head.

Common Name.—In North Queensland generally known as Sour Grass or Yellow Grass. In the Hawaiian Islands, where it is also a weed, it goes under the name of Hilo Grass. In the West Indies it is known as Sour Grass.

Properties.—Wherever this grass grows it is looked upon as worthless as a fodder. It is a common weed under rubber trees in Papuan plantations and I have seen working mules eat it and in conjunction with other feed do quite well on it; no doubt they were driven to it by the absence of other green grasses and herbage. The grass has occasioned some concern in the wetter parts of the Atherton Tableland, due to its invading dairying pastures to the exclusion of Paspalum and other good grasses, rendering the pasture practically useless for milk production.

Control.—The only method of control that suggests itself is ploughing out and replanting with some smothering grass such as Giant Couch (*Brachiaria mutica*), Kikuyu or similar kinds, and spelling the paddocks so as to give the better grasses a chance to establish themselves in spite of the competition of the Sour Grass.

Botanical Reference.—*Paspalum conjugatum,* Bergius, Act. Helv. Phys. Math. 7, 129, 1762.

Plate 149. Sour Grass or Yellow Grass (*Paspalum conjugatum*).

Cotton Varietal Testing.

By W. G. WELLS, Director of Cotton Culture.

THE introduction of the system whereby the Commonwealth Government bounty will be on lint cotton rather than on the unginned seed cotton will probably necessitate a change over to the method of paying the growers for their lint rather than for the seed cotton they send in, which has been the basis used since the commencement of the present phase of cotton-growing in this State.

On account of this, many farmers will probably want to try out several varieties, especially some of the big-boll, high-lint percentage types, to see if they can increase their yields of lint per acre. The following descriptions of methods of testing varieties have therefore been written to acquaint growers with some of the precautions which have to be taken to insure that results of reliable value are obtained from varietal trials.

It is pointed out, however, that varietal testing, if carried out properly, is a more difficult procedure than most growers realise. Frequently requests are received for an allotment of several varieties so that a test can be made of their comparative suitability, and quantities of seed sufficient to plant as much as five or more acres of each are ordered, with the idea of planting single areas of each. It is advised, however, that yields obtained from only one plot of each variety do not present reliable evidence of their merits. It is very probable that in such single-plot tests, if the position of the varieties had been otherwise, entirely different results would have been obtained, unless, of course, varieties of decided differences in yielding ability were being tried.

Investigators of agricultural problems throughout the world have long recognised the dangers connected with judging the merits of varieties by results obtained from only one plot of each, and methods have been devised to eliminate as many influences as possible that might affect the validity of the conclusions drawn from an experiment. Mathematicians have clearly demonstrated that increasing the number of plots of each variety in a test, undoubtedly allows of a much better gauging of the merits of each one. In recent years marked progress has been made in improving the technique of varietal testing, particularly in regard to the estimation of the reliability of the results obtained. These methods have been used here in cotton investigations for some years, and have been found highly suitable for the conditions. Growers should, therefore, use them more extensively than is the case at present.

If a test consists of only one plot of each variety, the question arises as to how the yields are affected by the position of the plots. If the rows are planted across a slope, which is the correct way to help reduce soil erosion, the varieties in the top or bottom plots may have decided advantages or disadvantages, according to the seasonal conditions. In a dry season the bottom acre plot will have the advantage of the soakage from the rest of the experiment, and obviously the variety grown on it might yield outstandingly better than any of the others, whereas in reality it might actually have considerably less yielding ability when under comparable conditions. If several plots of each variety are grown, however, a much better sampling of the soil can be

obtained, provided the same order of location of each variety is not followed each time, such as ABCD, ABCD, ABCD. Obviously if the same order is used each time variety D will have the advantage or disadvantage in each group of comparisons, for it will always be on the low side of the others.

Latin Squares.

A method has been devised wherein as many plots of each variety are planted as there are varieties in the test, and the positions of the plots are such as to subject each variety to approximately the same soil influences. This plan is called a Latin Square, and for testing from four to six varieties it appears to be well suited to Queensland conditions. In such an experiment four rows of a variety are planted in a plot, with the plots arranged in one long face and the rows running across the field. This allows of the using of a two-row planter, for the one round trip plants a plot. By measuring off the width of the experiment and tagging the location of each plot of a variety with rags of the one colour, all the plots of one variety can be planted, then all the different tagged plots of another, &c., the experiment requiring only a small amount of extra work over regular commercial planting. At harvesting time the whole row may be picked for the experiment, or a section taken from across all plots on uniform average soil, where the most regular stand can be obtained.

The following experiment illustrates how four varieties are located—the data being from an actual test carried out in the 1933-34 season:—

PLAN I.

Block.	1				2				3				4			
Plot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Number of Rows ..	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Variety	A	B	C	D	B	D	A	C	D	C	B	A	C	A	D	B
Yield lb. s/c.	35	31	35	43	25	49	44	42	41	35	26	48	36	35	34	26
Block Yield	144				160				148				131			
Block Yield on a per acre rate	1,162 lb. s/c.				1,291 lb.				1,194 lb.				1,057 lb.			

There were four rows in each plot of each variety, but only the cotton from the two middle rows of each plot was weighed, for it has been found that the first and last rows of a plot may be influenced decidedly by the adjacent variety. That is, if a tall rank growing variety is grown alongside of one of a smaller structure, the outside rows of both varieties may not give truly representative yields, hence in varietal testing the yields of the outside rows are not included in the results analysed.

It will be noted that although each variety occurs only once in each block of four plots in the experiment, there is a marked difference in

the block yields—Block 2 yielding at the rate of 1,291 lb. seed cotton per acre, whereas Block 4 yielded only at the rate of 1,057 lb. This shows clearly the variation in soil fertility that can exist in an experiment, and had only one variety been planted in each block, most misleading conclusions might have been drawn as to their merits. It is quite possible that B, the low-yielding variety, might have been planted by chance on the highest yielding block, if only one variety had been sown in each one. The superior yielding ability of the best block would therefore have given the low-producing cotton an advantage over the others, and thus might have put it in the lead, whereas in reality with a repetition of several plots, it was shown to be decidedly the lowest yielder.

If the plot yields of the included test are grouped as in Table I., the variation in plot yield within the one variety is shown—yet it will be noted that variety B is consistently lower than any of the other varieties in each block. The results are obviously of much more value, therefore, for this variety has yielded the lowest in all four comparisons, whereas if only one block of each variety had been planted this variety might have been in the lead.

TABLE I.

PLOT YIELDS OF EACH VARIETY (2 INNER ROWS $= \frac{1}{32 \cdot 27}$ of an acre.)

A	B	C	D
35	31	35	43
44	25	42	49
48	26	33	41
35	26	36	34
*40·5	*27	*36·5	*41·75

* Mean yield in lb. of seed cotton.

It can thus be seen that it is necessary to have several plots of each variety in order to obtain a thoroughly representative sampling of the soil on which the experiment is being conducted.

Lint Yields.

It has been shown how necessary it is to have accurately determined results before the yielding ability of a variety, in terms of seed cotton per acre, can be determined. With the payment of the bounty on lint cotton, it becomes all the more imperative to ascertain the true yielding ability of a variety, for the main varieties being grown in Queensland range from slightly over 32 per cent. lint up to 40 per cent. under average conditions. On some soils a variety producing 39 per cent. lint may yield less seed cotton than a low lint per cent. variety, and yet the amount of lint produced, due to the higher lint percentage, may make the former variety a more valuable one to the grower. It does not follow, however, that a variety with a high lint percentage will always produce more lint or greater monetary returns per acre

than will a variety with a low lint percentage. This is amply demonstrated in the experiment that has been used to illustrate the points made in this article, as is shown in Table II.

TABLE II.

Variety.	A	B	C	D
Yield per acre lb. s/c.	1307	871	1178	1347
Yield per acre lb. lint	423	340	448	488
Lint percentage	32·4	39	38	36·25

It will be noted that varieties A, C, and D produced more seed cotton and lint per acre than B, although they had a lower lint percentage, A being only 32·4 per cent. as compared to 39 for B. This experiment was carried out on alluvial clay loam where varieties of the type of B are not suited, especially in seasons of heavy rainfall at mid-crop. In the drier districts such a variety, which is of the drought-resistant type, has much more promise of producing the highest yield of lint per acre.

Randomised Blocks.

Where three or more than six varieties are to be tested, it is advisable to use the method known as Randomised Blocks, for with three varieties there are not enough plots in a Latin Square, and with more than six varieties a Latin Square becomes too cumbersome, for there would be thirty-six plots when testing six varieties, as each variety has to be repeated as many times as there are varieties. With three varieties four or more plots of each are preferable, while with over six varieties four plots of each are ample to measure fairly small differences in yielding ability if the soil is at all uniform. The main feature of a randomised block experiment is that it is much more elastic than a Latin Square, although it does not measure small differences in yields with quite such precision. A farmer with a 100-acre field of varying fertility in the different portions may use a randomised block experiment to ascertain the most suitable of several varieties for the whole of his field, by planting a block consisting of one acre of each variety in several places in the field. The yields obtained from each acre plot can be combined into one experiment for analysis to ascertain if any one of the varieties gives a definite indication of being the most suited on the average for that field.

Likewise, varieties may be tested for a subdivision of a district, by each of eight or ten growers planting equal areas of all varieties being tried. All the growers must plant at the same time, however, use the same cultural methods, and carry out comparable standards of cultivation, otherwise there will be so many variable factors affecting the results that the main question—Which variety is the most likely to yield the best on the majority of the soils in the area?—cannot be answered. The Cotton Section of the Department of Agriculture is using this method in conjunction with Latin Squares, in order that all soil types in a district may be sampled, and a large number of growers have the opportunity to study several likely varieties for their areas

without running any risk of losses of serious consequence. Decidedly greater accuracy could be obtained, however, if all the growers planted Latin Squares, for then it could be decided which was the most suitable variety for each grower.

Student Method.

In some cases a grower may be interested in trying only one variety against his regular one, and where this is desired a simple yet efficient test is available. It consists of planting alternate plots of six or eight rows of each variety until at least four plots of the first variety and three of the second one have been sown, i.e., seven plots in all. At picking time the plots are harvested as shown in Plan II. This plan is well suited for testing two varieties on a slope, for one variety is first on the up side and then on the down side of the other, and if any consistent superiority in yield is shown, it is fairly indicative that the leading variety is the better one and that soil variability has not produced the difference in yields.

PLAN II.

Plot	1	2	3	4	5	6	7
Variety	A	B	A	B	A	B	A
6 rows	123456	123456	123456	123456	123456	123456	123456
Row numbers to be picked separately for weighing	4, 5, a^1	2, 3 b^1 | 4, 5 b^2	2, 3 a^2 | 4, 5 a^3	2, 3 b^3 | 4, 5 b^4	2, 3 a^4 | 4, 5 a^5	2, 3 b^5 | 4, 5 b^6	2, 3. a^6

Only the numbered rows, namely, the fourth and fifth in plot A1 and the second and third in A7, and rows 2, 3, 4, and 5 in the other plots, are weighed. The yields are then compared as shown on the bottom line of the plan, a^1 against b^1, b^2 against a^2, &c., the two rows in each case being added together to represent a plot yield.

Analysis of Results.

The value of conducting experiments along the lines of the three methods which have just been described lies not only in obtaining the average yield of a variety from several scattered plots in a field rather than from only one plot, but also in that the results can be analysed to ascertain how reliable they are. With only one plot of each variety there is no way of determining how reliable the yield is. Methods have been devised whereby the results of experiments, like the ones described, can be studied, and an estimate made as to the probability of the yields being thoroughly indicative of the merits of each variety. The significance of the results is expressed in odds such as 19 to 1. This means that if the experiment could be repeated twenty times on the same soil and under the same climatic conditions, in only one trial would a variety which was so significantly ahead be likely to be surpassed by any of the other varieties. Investigators throughout the world accept odds of 19 to 1 as being indicative of reliable ability on the part of one variety to outyield another.

It is necessary that such an analysis be made of the results obtained from experiments. In many tests of cotton varieties that have been

conducted here, yields have been obtained which would appear to indicate that a variety might be ahead by a substantial margin, yet when the data were analysed no significant differences were shown, that is, the odds were less than 19 to 1. In some cases checks on the yields from the experiment were available in the form of pickings from the portions of the rows that were not used in the experiment, and the variety which was ahead in the test but not significantly so, was surpassed in the bulk pickings by the second highest yielder in the test, thus demonstrating the validity of the conclusions drawn from the results obtained in the experiment.

More Varietal Testing Required.

It can be seen, therefore, that careful testing of the merits of each variety will be necessary before their full possibilities will be known. The tendency of many of the growers to try only one plot of each variety will have to be changed if this is to be accomplished, for while valuable information can be obtained from such a method as to the opening of the bolls, freedom from insect pests and the general suitability of a variety for a district, no accurate comparison can be made as to the relative yielding ability of the different varieties which may be thought to have possibilities. The new tariff schedule will necessitate more of the harder bodied cottons being grown. This possibility was visualised several years ago, and ample supplies of seed are available to meet requirements. The most suitable soil types and districts for these varieties have been fairly well ascertained, but it is necessary that they be extensively tested in carefully conducted experiments in order that the most profitable for each main soil type and district can be determined. The Department of Agriculture and Stock is investigating the merits of a large number of varieties, and as their requirements become understood they will be released for general testing. Unless sufficient growers co-operate in conducting reliable tests of them, the true value of each variety cannot be ascertained. A large number will eventually have to be discarded, for it is advisable to grow as few varieties as possible on account of the danger of contamination of seed at the ginneries, and to establish a general uniformity of lint produced. Without the results from a comprehensive series of carefully conducted tests, it will be extremely difficult to decide on the most valuable varieties to keep.

The growing of only one variety in a district is highly advantageous if at all possible, not only on account of the pure seed operations, but where only one variety is grown the growers will concentrate on studying their cultural methods to ascertain causes of low returns rather than blame the variety they are growing. If most of the growers in a district are obtaining good yields from a variety, there is obviously some local cause for failure on any particular farm, and experiences over several years have indicated that the explanation of such low yields can often be obtained without changing the variety. It is to be hoped, therefore, that greater interest will be shown in carrying out properly designed tests. The Cotton Section of the Department of Agriculture and Stock has prepared plans for the laying out of such experiments as have been described, and will be only too pleased to forward the same free of charge to interested growers, and to analyse

the results obtained if returned to the Department. Anyone interested in carrying out such tests should communicate with the Cotton Instructor for his district, or with the Department of Agriculture and Stock, Brisbane, giving information as to his soil type, the acreage to be sown, results that have been obtained with cotton in the past, and varieties that have previously been tried.

A CALF-PROOF GATE.

The gate illustrated is a handy type of bush gate in common use in Western Australia. It is made of round bush timber. The top rail and latch posts are made of forked posts, bolted together; the fork on the top rail makes the gate rigid, as it acts as a brace, and the fork on the latch post is at right angles, and prevents the gate from sagging and leaning over when closed; also when open it stands upright in any position, and it is easy to close. The hinge end of the gate is simple. Bore a hole in the top of the post and through the top rail, and insert an iron peg with a big washer or piece of iron plate with a hole in it. The washer makes it turn easier. Taper the post to a point, also to stop friction. The centre rails are hung loosely with wire; if a calf or sheep lean against them they push them upwards, and they cannot get through.

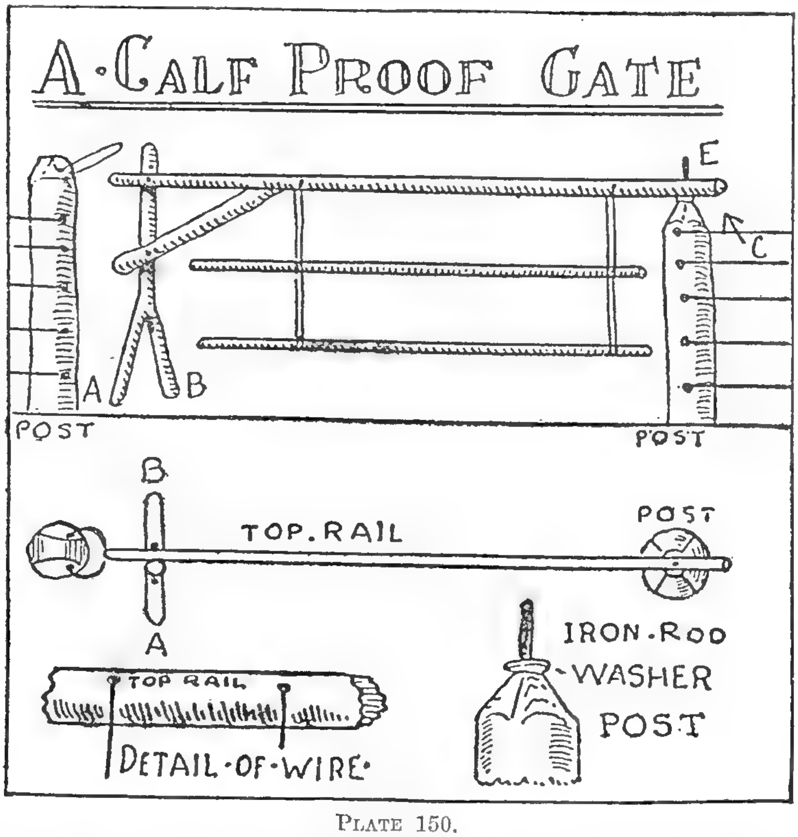


PLATE 150.

The top drawing shows the gate with posts at side and fence wires. The upright latch post of the gate has a fork A B, at right angles to the gate. E is an iron rod on top of the hinge post. C shows the position of the washer. The second sketch shows a plan of the gate. The bottom left-hand sketch shows the position for boring holes in the top rail for wires near the top of the rail. The bottom right shows the gate post tapered off, washer, and iron rod. This gate is cheaper and a lot handier than wrestling with an ordinary wire gate.

Factors Relating to the Production of the Harder-Bodied Cottons.

By W. G. WELLS, Director of Cotton Culture.

THE Tariff Schedule tabled recently has enlarged the market for the Australian spinners in several classes of yarns that can best be manufactured from the harder-bodied 1 to $1\frac{1}{16}$ inch cottons. It will be necessary, therefore, for the Queensland growers to produce more of this class of cotton in order that the spinners may operate on the most efficient basis. Fortunately, it appears entirely feasible to supply the quantities of such cottons that will be required, provided proper attention is paid to the selection of soils suitable for their profitable production. The following article has been prepared to present to growers important factors bearing on the production of these types of cotton.

Results from Early Tests of a Variety Producing a Hard-bodied Cotton.

The Department of Agriculture and Stock realised in the early stages of this present phase of cotton-growing, that varieties producing the harder-bodied medium staples would probably be required for some of the climatic conditions of the districts where cotton might be grown. Seed of the Lone Star variety, which was the outstanding American cotton of this type at the time, was accordingly imported in 1923, and fairly satisfactory results were obtained with it at first. Very unsatisfactory yields were generally produced, however, when more extended tests were made, especially in the districts with harsher climatic conditions where such a variety might have been expected to be eminently satisfactory. Tests were continued with it, however, and breeding operations were instituted to develop suitable acclimatised strains, for in a few trials it produced profitable yields of fibre of good quality.

Explanations of Early Results.

In the course of further investigations in the Lone Star and other varieties, it became apparent that many of the problems connected with growing cotton in this State were not solely a question of finding suitable varieties, but in reality the much broader subject of either selecting suitable soils, or of adopting cropping systems which would maintain the soil in a proper condition for producing profitable yields of cotton. With the opening up of the Upper Burnett-Callide Land Settlement Scheme for closer settlement, large areas of virgin country were brought under cotton cultivation. During the first few years excellent returns were obtained, especially on the alluvial soils, but with continued cultivation of cotton, the returns diminished steadily. It was noted, however, that the yields obtained on land newly brought into cultivation, though often adjacent to old cultivations, were generally satisfactory, and in the investigations of the causes it was ascertained that the nitrate content and carbon-nitrogen ratio of the soils played a very important part in the returns that were obtained from cotton.[1] When this aspect of the work had been well demonstrated, the possibilities of producing a wider range of cottons in many of the districts were greatly increased.

(1) See "Cotton Growing on New Cultivations," by W. G. Wells, "Queensland Agricultural Journal," April, 1934.

Further Importations of the Harder-bodied Cottons.

More varieties of types producing the harder-bodied cottons, which, in the earlier stages of cotton growing here, did not appear to have possibilities for many of the districts, have accordingly been imported, and with proper selection of soil types several have yielded promising results under a wide range of seasonal conditions. The seed stocks of these were increased, and during the 1933-34 season sufficient supplies of the varieties yielding the harder-bodied 1 to $1\frac{1}{16}$ inch cottons of good strength were produced to meet all requirements. Breeding centres have been established for each of the most promising varities, and supplies of improved seed are being developed. Test plots and varietal trials have been conducted of all except the most recently introduced varieties, and a sufficient understanding of their possibilities has been obtained to allow of their allotment to growers with reasonable prospects of their producing profitable yields.

PLATE 151.—TESTING FOR STRENGTH AND DROUGHT RESISTANCE IN A BIG BOLL VARIETY.

Each season thousands of plants are examined by the Cotton Section of the Department of Agriculture and Stock, and upwards of 2,000 plants are picked individually for further inspection in the laboratory. Progeny rows of the plants selected finally as worthy of further study are planted in the following season in breeding blocks, where the uniformity of plant and fibre characters is carefully studied. The most promising progenies are kept for further increase and trial. In this manner suitable strains are being developed of the main varieties now being grown.

The position is, now, that the Department is faced with the problem of eliminating as many varieties as possible after their full possibilities have been ascertained. The co-operation of the growers on a much larger scale than has been given by them in the past, is therefore, necessary, in order that a comprehensive sampling of the various soil types in every district may be obtained with each variety. Carefully conducted varietal trials of the type described in "Varietal Testing"[2]

(2) See "Varietal Testing," by W. G. Wells, "Queensland Agricultural Journal," September, 1934.

will be required for several seasons before much elimination can be effected in some districts, while in others the problem will be simpler. As pointed out in "Varietal Testing," the trials must be of the proper type, however, for the tendency of the growers in the past to compare their results obtained from a field of only one variety, with that of a neighbour having a different one, or to compare the yields of single plots of several varieties on the one farm, is of little value as far as yielding ability is concerned, and often serious confusion of thought arises amongst the growers in a district, due to the conclusions obtained in such a manner. Undoubtedly, in many of the subdivisions of some of the districts it will be possible to reduce the number of varieties to one, or possibly two, where diverse soil types exist, and it is to the interest of all concerned that such simplification be speedily effected.

Suitable Soils for Varieties Producing the Harder-bodied Cottons.

Generally speaking, it appears that the big boll types producing the harder-bodied cottons will be better suited for the harder clays and clay loams of the following types:—The slopes originally under ironbark or box-trees; the poorer box flats, especially where they join the lower brigalow scrub slopes; the brigalow scrub slopes; and the brigalow and belah scrub mixtures. Likewise, the harder or the poorer soils of the brigalow and softvine scrub mixtures; the poorer shallow sandy loams overlying clay subsoils in both forest and scrub; and some of the heaviest clay types of the alluvials, such as the black soils of the open plains type adjoining the box country, are also well suited. All these soils, particularly if they have not been under cotton cultivation for more than four or five years appear to be capable of producing heavy yields of this type of cotton under reasonably favourable conditions. Which variety, is a matter of experimentation in some districts, while in others rather clear-cut indications have been obtained that some of these cottons are not suitable. It is confidently anticipated, however, that a satisfactory selection of suitable varieties can be accomplished if sufficient growers will assist in carrying out properly conducted tests.

It is pointed out, however, that it appears unlikely that over a series of seasons satisfactory yields will be produced with most of the big boll hard-bodied cottons, on the more fertile alluvial loams, or on the soft vine scrub soils of high nitrate content. In occasional seasons with either low rainfall, or when very heavy rainfall is experienced in the spring and early summer, and moderate amounts at mid-season, good yields may be obtained with these cottons over a wide range of soils.

Relationship of Soils to Varietal Types.

All the suitable classes of soils described above are usually of only moderate nitrate content and mostly have a stiff clay subsoil, a combination that seems to be very favourable for the production of satisfactory yields of cotton, especially of the harder-bodied types. The explanation of their suitability appears to be that with the low nitrate content and harder soils, only moderate plant growth is made, particularly in wet seasons when a partial water-logging of the soil tends to produce the effect of a physiological drought—the plants being of a small and toughened type. This does not appear to handicap the big boll varieties producing the harder cottons, but types producing medium-bodied fibre are undoubtedly sometimes affected during dry

periods. Investigations carried out at the Cotton Research Station have shown that the nitrates of the surface soils are easily leached through the first 18 inches of soil, and apparently where a clay subsoil exists around this level, sufficient nitrates and soil moisture are accumulated to enable the big boll types to carry through fairly stress periods with only moderate damage to either yield or quality of the crop.

A different result is obtained, however, on the deeper alluvial more fertile loams and clay loams, or on the deep scrub soils of high nitrate content. With the higher nitrate content of all these soils, a greater stimulation exists to produce a larger and sappier growth of plant structure of all varieties which is more subject to crop losses from various causes. Shedding in prolonged dry periods and then physiological shedding during luxuriant growth in a following wet spell; insect attacks removing a large amount of the crop and then rank growth occurring, afterwards accompanied by further insect attacks or physiological shedding, especially if wet weather of any duration is experienced, may all affect the returns obtained from these soils. The big boll harder-bodied types all tend naturally to make rather vegetative growth on such soils, and appear more susceptible to disaster than the more open types producing the medium-bodied cottons. Apparently if serious

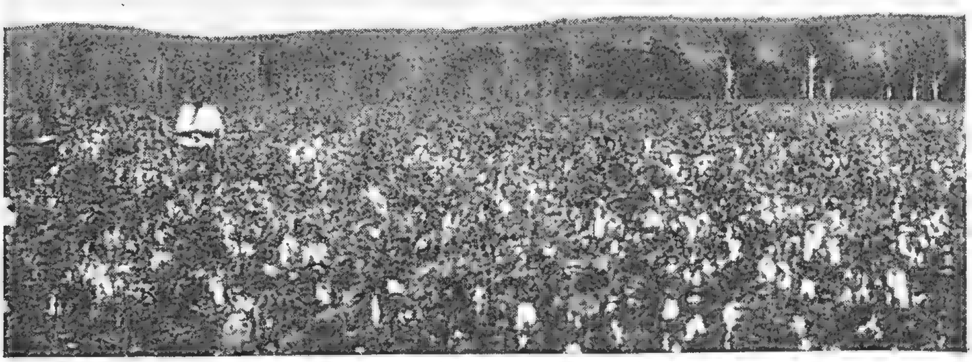


PLATE 152.—A FIELD OF DURANGO COTTON.

A good crop of the Durango variety on a representative better class of alluvial loam of the Callide Valley.

loss of crop occurs around mid-season in the big boll drought resistant varieties, there is such a definite tendency to the formation of what might almost be termed a determinate habit of growth, that only a light recovery of crop is effected, except under the most favourable conditions.

It has been clearly demonstrated, however, in investigations carried out at the Cotton Research Station, that the varieties of more open habit of growth and producing the medium-bodied cottons, such as Durango, Indio Acala, and Starvale, are quickly able to develop a fruiting structure well loaded with flower buds after a disaster has been experienced. If reasonably favourable conditions follow, a crop is obtained which, in some seasons, is of astonishing magnitude. This

particularly applies to Durango, which has often produced profitable returns in many of the districts after a serious loss of crop has been experienced, even as late as the end of February. This factor is of outstanding value on the alluvial loams, and unless a variety with similar ability can be found in the harder-bodied cottons, it is questionable if it will be advisable to substitute any of them for Durango, even a variety producing fairly satisfactory yields under average conditions, for Durango has so often produced profitable crops after disasters have occurred. It may be possible, however, to develop suitable strains of the medium-bodied cottons such as Indio Acala or Starvale for these soils, and investigations along these lines are in hand. As both varieties have a higher lint percentage than Durango, some increase in yield of lint might be obtained in seasons when late crop disasters are experienced.

The effect of soil types on the relative yielding ability of the high and low lint percentage cottons is shown in Table I. in a comparison of the results obtained in two varietal tests of the same four varieties conducted in a district in the 1933-34 season.

TABLE I.

SOIL TYPE—3 YEAR OLD CULTIVATION—LOAMY SOIL ADJACENT BRIGALOW SCRUB SLOPE.

Variety.	A.	B.	C.	D.
Yield per acre in lb. seed cotton	1307	871	1178	1347
Yield per acre in lb. lint cotton	423	340	448	488
Lint per cent.	32·4	39·0	38·0	36·25

SOIL TYPE—5 YEAR OLD CULTIVATION—ALLUVIAL LOAM ORIGINALLY COVERED WITH BLUE GUMS, MORETON BAY ASH, AND IRON BARK.

Variety.	A.	B.	C.	D.
Yield per acre in lb. seed cotton	1135	563	835	847
Yield per acre in lb. lint cotton	368	220	317	307
Lint per cent.	32·4	39·0	38·0	36·25

In the first experiment on the newer cultivation, and possibly slighter heavier soil, variety D significantly outyielded all others, and variety C barely significantly outyielded A. All were significantly better than B, which had the highest lint per cent. Thus, two of the three high lint percentage varieties were better than A—which had the lowest.

In the second experiment on the older cultivation of alluvial loam, the low lint percentage variety A, which was of the most open type of growth, significantly outyielded all. There was no significant difference between C and D, while B was outstandingly low again, although it was of the highest lint percentage. In both experiments B experienced the most losses from boll rots. The results of the two experiments are in keeping with the usual behaviour of these varieties, and indicate

clearly the necessity of selecting suitable soil types for the different varieties.

Necessity for Ample Supplies of Hard-bodied Cottons.

It must be remembered, however, that the New Tariff Schedule has extended the markets for the Australian spinners in the yarns requiring the harder-bodied cottons. It is necessary, therefore, that ample supplies be grown of such cottons, and where there appears any possibility that they can be grown profitably, the Department is allotting seed of the most suitable varieties producing these types of lint. Fortunately, large areas of the harder-soil types occur in many of the main cotton-growing districts, so that it will be possible to grow ample supplies of such cotton. As these soil types are less suitable for the medium-bodied cottons in very dry seasons, a higher general quality for the whole of the Queensland crop should be obtained over a series of seasons. Growers with suitable soils such as have been described in this article should, therefore, apply for seed of the harder-bodied cottons.

Lint Percentages.

The introduction of varieties producing the harder-bodied cottons has brought into prominence the question of the advantages of producing varieties with a high lint percentage, and undoubtedly many growers will be inclined to grow them under the impression that the higher lint percentage a variety has the greater will be the yield of lint per acre. This appears plausible, but has been disproved in Queensland and in many other parts of the world. The suitability of the high lint percentage varieties producing the harder-bodied cottons depends largely on the soil type and the seasonal conditions. Where suitable soils such as have been described are available, undoubtedly under average conditions, yields as heavy or even appreciably heavier than those produced by the lower lint percentage cottons will be obtained with some of them, and often the quality of the lint will be superior, especially in dry seasons. It does not follow, however, even on suitable soils for the cottons producing the harder-bodied fibre, that the variety with the highest lint percentage will produce the most lint. A variety which does well in a district usually experiencing fairly good rainfall may not be at all suitable for a drier district, although it is planted on suitable soil types in both instances. Conversely, one of the big boll drought-resistant cottons with a very high lint percentage may yield excellently in a dry district, but will give very poor returns of low-grade lint in a wet district, even if planted on a soil suitable for the big boll types. The following data, which was obtained in an experiment conducted in the 1933-34 season on a bloodwood-ironbark slope well suited for the production of the big boll types of cotton, illustrates the point clearly, and shows the necessity for growers to conduct carefully planned experiments to ascertain the most suitable variety for their conditions, rather than to order a variety because it has a high lint percentage.

Variety.	A.	B.	C.	D.
Yield per acre in lb. of seed cotton	1059	656	817	867
Yield per acre in lb. of lint cotton	363	256	310	317
Lint percentage	34·3	39·0	38·0	36·5

Variety A, which was of the lowest lint percentage and was of the quality desired by the Australian spinners for a large amount of their yarns, significantly outyielded all other varieties, while B, which had the highest lint percentage, was significantly lower yielding than any.

Lint Percentages do not Necessarily Determine the Value of a Variety.

It can thus be seen that a high lint percentage does not necessarily indicate a high yield of lint. Soil and climatic conditions, susceptibility to insect attacks, plant structure, and quality of fibre produced, play an important part in the results obtained from a variety of cotton. This is recognised in all cotton growing countries. In some parts of the United States of America the varieties with the highest lint percentages produce outstandingly the heaviest yields; in other parts, generally in the same State, soil or climatic conditions make the production of substantially lower lint percentage varieties decidedly more profitable.

It is necessary, therefore, that a wide range of cottons differing in lint percentages, types of fibre, habits of growth, &c., be tried, and the Department of Agriculture and Stock has a large number of varieties under trial which have been obtained from different countries. In the first tests some of these have produced excellent yields, but the drag of the fibres was so lacking that decided improvement was obviously required before the variety could be grown commercially. Drag is the name used to describe the clinging power of the fibres, and unless a cotton has a good drag it handicaps the spinner in producing a strong yarn. Other varieties have yielded very well, yet the general quality of the fibre was lacking in many respects. A considerable number of varieties have been discarded for various causes, after careful testing for several seasons, which is the period required before the true merits of a cotton are known.

It is suggested, therefore, that before ordering planting seed a grower should get in touch with the Cotton Officer of his district, or write direct to the Cotton Section, Department of Agriculture and Stock, Brisbane. A description of the soil type on which cotton is to be grown should be included, along with such details as the acreage; trees originally on the soil, whether slope or alluvial, if old or new cultivation, results that have been previously obtained with cotton, and the varieties tested. The most promising variety will be allotted, based on results that have been obtained in tests carried out under similar conditions. It must be realised, however, that any variety of any agricultural crop may fail under unfavourable conditions. Unforeseen circumstances may cause poor returns or failures to be obtained from the selected variety. If it is a big-bolled hard-bodied type of cotton, it does not follow that these cottons are not suitable for the particular soil, for it has been shown how varieties yield varying returns according to soil and climatic conditions. If unsatisfactory results are produced, a test should be applied for in the following season to ascertain the most suitable variety, as varieties are now available for the majority of our cotton soils.

Conclusions.

1.—A greater production of the harder-bodied medium staples is now required in Queensland.

2.—A sufficient acreage of suitable soils is available in the regular cotton districts to produce ample supplies of these cottons.

3.—The harder types of soils are the most suited for the profitable growth of the varieties producing cotton of such character.

4.—These varieties are not generally suitable for the more fertile loams of high nitrate content, especially the alluvials of the districts of heavier rainfall.

5.—The medium-bodied cottons have yielded the best returns so far on such soils.

6.—The varieties with the highest lint percentages do not necessarily produce the highest yield of lint on all soil types.

7.—The harder-bodied cottons should be grown wherever the soil types are suitable, but it is suggested that the Cotton Section of the Department of Agriculture and Stock, Brisbane, or the District Cotton Instructor, should be communicated with regarding the most promising variety.

ANOTHER USE FOR A RAZOR BLADE.

Leather belt lacing frequently requires trimming, and when this is the case and a belt breaks, one often has quite a problem to effect repairs without losing too much time. An excellent tool for cutting belt lacing or even trimming the ends of belts when shortening is necessary can be made from a discarded safety razor blade, which

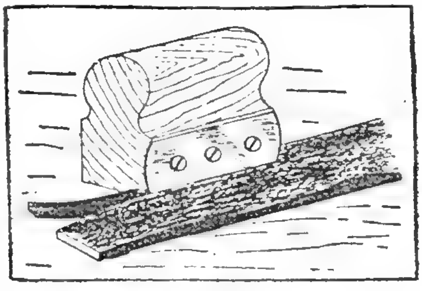


PLATE 153.

is mounted on a block of wood. The block should be curved to fit the fingers and one side at the bottom grooved or relieved to the width and thickness of the lacing required. The blade is then fastened to the block with small wood screws and the relieved portion of the block will then serve as a guide so that the edge of the blade is always parallel and the lacing will be of equal width along its length.

Common Mistakes in Bright Tobacco Production.

By N. A. R. POLLOCK, H.D.A., Senior Instructor in Agriculture.

IT is probable that in looking back on their efforts in the production of bright tobacco in the past and previous seasons there are few growers who do not recognise that there was much room for improvement in yield as well as quality in the crops they produced.

In "Tobacco Growing in Queensland" an endeavour was made to define a correct procedure in the production of a crop through various phases, from soil selection to the marketing of the leaf, as well as in pest control and precautions to be taken in the prevention of disease.

While slight departures from the lines laid down may not in certain directions be detrimental, carelessness in others has been the forerunner of more or less diminished yields with reduction in quality.

Just as a faulty foundation imperils the structure built thereon, so a wrong procedure at the outset in crop production is liable to foreshadow misfortune later on.

Seed-beds.

In a tobacco crop particularly, the provision of strong, healthy plants to set out in the field from the seed-beds is of maximum importance.

The soil of the seed-beds should be fine, friable, and fertile, and contain a good supply of humus and decaying organic matter; an advantage is usually gained when a top-dressing of superphosphate or a complete tobacco fertilizer at the rate of one to one and a-half ounces to the square yard is given prior to sowing the seed.

Seeding should not be too heavy, a small teaspoonful or one-twelfth of an ounce being sufficient for 100 square feet. Water should be applied judiciously to allow the plants to make a strong, uninterrupted growth up to the time of transplanting. Where plants are crowded they should be thinned or pricked out into another bed.

Faults with many seed-beds were noted as infertility, insufficiency of organic matter, and poor texture. In the latter, coarseness of the particles, as in very sandy soils, disallowed sufficient retention of moisture and the necessary close contact with the tiny rootlets when the seeds had germinated. In clayey soils overwatering caused stunted growth and root troubles.

Failure to burn the beds also allowed nematode infestation and probably some of the trouble from fungi.

Growers are advised to pay particular attention to their seed-beds. A good plan is to dig in fresh supplies of farm yard manure or well-rotted vegetable matter each year as soon as the fields have been planted up, and to grow table vegetables thereon until the approach of the next season when the beds should be dug up and fired in preparation for seeding. Firing of the seed-beds each year should not be neglected.

Disease.

Disease cannot be regarded as a natural concomitant of either plants or animals. Each is provided with a natural resistance proportionate

to its vigour, but when vitality is lowered through inbreeding, injudicious mating, improper selection of seed, inanition or ill-treatment, such is more readily overcome and trouble engendered. The tobacco plant is probably more subject to attack from fungous diseases with consequent loss than any other cultivated. This fact is insufficiently appreciated by the average grower whose carelessness is responsible in most instances for losses in seed-bed and field. Blue mould is by far the most damaging trouble experienced. As far as is known its attack is confined to species of the genus nicotiana, plants of other species, even when somewhat closely related, appearing to be immune. While with many crops the major diseases are more or less controlled by the growth of known resistant varieties, no success in the evolution of a variety of tobacco resistant to blue mould has yet been obtained. In its incidence, it is analagous to Late or Irish blight which occasionally causes much loss in crops of potatoes and tomatoes, since it appears epidemic in certain seasons when climatic factors probably operate to favour its development.

The fact that in seed-bed and field a mild attack is sometimes confined to a few plants here and there suggests a lack of vitality therein may be responsible.

Particular attention should be paid to seed-bed sanitation in order to promote strong growth of plant. Early growth is invariably more susceptible to disease than later, and it is in this stage that troubles are most often contracted.

In addition to care in the preparation of the seed-bed further precautions against disease should be taken in the application of fungicides, particulars of which are set out in the admirable contribution on diseases to "Tobacco Growing in Queensland" by Mr. L. F. Mandelson, and also in his Additional Recommendations for the Control of Blue Mould, Advisory Leaflet No. 7, published by the Department of Agriculture.

Sprayings to be effective should not be applied perfunctorily but regularly, as advised therein and according to directions. The objective, it should be understood, is to prevent the entry of disease by the destruction of spores which may come in contact with the film of fungicide covering the young plant, hence the necessity to maintain this film by regular and frequent applications in such a manner as to keep covered both under and upper surfaces of the leaves as well as the stems.

Once contracted, disease in the plant is not regarded as possible of cure, certainly not within a time that would allow of adequate return during the season of growth. The cost of material and labour involved in the control of disease and insect pests is not high and will be repaid many times from the added value of the crop returned.

In field practice much of the trouble experienced from leaf spots would have been avoided, or at least lessened, by heavier priming. This allows access of light and a freer circulation of air at the base of the plant, both of which are regarded as repellant. The removal of these leaves, usually of poor texture, cannot be regarded as a loss, but rather as a gain, for the nourishment otherwise used in their development will be devoted to the production of others higher on the plant, which will be of better body and not damaged by contact with the soil.

Insect Pests.

Much of the trouble caused by insect pests has been due to unsound cultural practice in which failure to eradicate and destroy plants

immediately harvest of leaf therefrom has been completed or abandoned as well as volunteer plants was common.

Careful perusal of the subject matter of "Tobacco Pests," by Mr. J. Harold Smith in "Tobacco Growing in Queensland," should convince growers that sound cultural practice will very seriously diminish such insect population.

Two of the worst tobacco pests are the stem grub or borer and the leaf miner which are closely related. As their depredations occur within the leaf or stem, control is not possible by sprays or poison baits. Destruction of the grub by burning the leaf or affected part of the stem immediately attack therein is noted is strongly advocated. Mr. Smith advises the adult moth is capable of laying as many as 150 eggs. The destruction thus of one grub or its pupa suggests protection from the ravage, potentially, of 150 individuals two or three weeks later. His remarks on the practice of many insects to pupate in the soil are worthy of note, as they stress the value of cultivation during growth and between seasons.

Fertilizers.

The use of fertilizer on the tobacco crop is not as general as is considered desirable. Even the most fertile soils produce a better leaf quality under judicious applications, since ripening is thereby accelerated and a better colour secured under cure.

Trials repeated in different districts and on various types of soil over a series of years will be necessary before a definite recommendation of a particular mixture for each can be made. So far, however, results from the use of the 4—12—6 mixture suggested in "Tobacco Growing in Queensland" are most encouraging, so much so that it is confidently predicted the conclusive result of years of experiment will be a recommendation of this mixture or of one very close thereto. Used at the rate of 2 lb. to the chain of hill or row, it has, in competition with other mixtures, given the best results, not only on the poorest soils but on the most fertile on which tobacco has been recently grown.

Where plants are set out in rows 4 feet apart the collective length of rows in an acre would be approximately 160 chains. At 4 feet 1½ inches it would be exact. Applied at 2 lb. per chain 320 lb. would be necessary for the acre or 1 ton sufficient for 7 acres. The 4—12—6 mixture, according to the Departmental formula, is quoted at £11 per ton f.o.b. Brisbane. Allowing as much as £3 per ton for carriage to the farm, an application of 320 lb. would signify an expenditure of £2 per acre.

Green Manures.

Leaf quality is definitely influenced by the quantity of humus and decaying organic matter in the soil, a fact that is insufficiently appreciated by growers. Many will have noted the absence of the lustre or shining brightness in cured leaf of later crops that was so apparent when virgin soil was first used for the purpose. Experience of tobacco leaf auction sales suggests that lustre in the leaf offered means an advantage of at least 3d. per lb. This increase in return, without consideration of the higher yield, would more than compensate for the cost involved in growing a crop and turning it under for green manure. A sufficiency of humus in the soil is absolutely necessary for profitable production, and its maintenance should be the objective of every grower.

Where it is practicable to to grow other money crops, such as maize or potatoes, that benefit from the turning under of a legume, cowpeas or velvet beans in summer, or field peas or vetches in winter, can be commended as green manures provided a crop of another kind precedes tobacco. Where tobacco is to follow a green manure, Sudan grass, sorghum, maize, or millet in summer, or ryecorn, barley, wheat, or oats in winter, offer choice.

Irrigation.

Over-irrigation, improper application of water and under-cultivation conjointly, were the cause of poor returns in many instances. Excess of soil moisture induces root rots through which leaf is apt to yellow prematurely and quality suffer, while in extreme cases, especially in early growth, the plant may be killed. Personal notes in the June, 1934, issue of the "Queensland Agricultural Journal" are worthy of perusal.

The practice of setting out plants in or on the side of the furrow carrying the water in irrigation is undesirable. Though the strike is generally satisfactory through root contact with wet soil, subsequent growth is impeded by the brick-like structure of the soil consequent on the evaporation of moisture therefrom. Further applications of water certainly soften the soil for a little while but add another defect in promoting root or stem rot.

Growth on hills with fewer applications of water and more cultivation to aerate the soil and retard evaporation is calculated to improve yield and leaf quality.

Spacing.

The setting out of plants at intervals of 2 feet in rows 4 feet apart appears to be most satisfactory and is generally recommended. Closer spacing in and between rows tends to exclude sunlight and prevent the free circulation of air. Leaf, as a consequence of growth in the shade, lacks body and does not sell so well. With lesser intervals between rows, also, cultivation cannot be so easily effected.

Cultivation.

Lack of cultivation was not generally common, but is capable of improvement, especially close to the plants. Weed growth should not only be kept down but a loose surface maintained in the soil up to the time of topping, when further attention is neither necessary nor desirable.

Priming.

As noted previously, improvement can be effected by a heavier priming than is usual. Not only will leaf quality be improved without diminution of yield, but damage from fungi causing leaf spots will be lessened.

Topping.

Experience has convinced most growers that it is better to delay topping until a few flowers have opened and then to top high rather than low. In a good growing season high topping is imperative as otherwise the leaf is apt to become coarse and cure a darker colour than is desirable. With high topping the two or three top leaves, usually narrow, are not worth harvesting. The amount of nourishment for their production is compensated by the better texture of lower leaves and the lesser growth of suckers.

Suckering.

Neglect of suckering was to be seen in many instances where they had produced flowers. Loss was consequently sustained in leaf body and damage to the web when picking. Too frequently the grower had planted an acreage beyond the capacity of the labour available. Suckers should be removed when they are about an inch long, as they are then easily broken off by pressure of thumb or finger. Working with both hands systematically, with an appreciation of the manner in which the leaves spiral the stem, the operator soon becomes expert. When suckers are allowed to grow more than 2 inches they are not so easily broken, frequently the leaf adjoining is broken off, and, at times, the sucker has to be cut with a knife. The longer time occupied, then, adds to the cost of production while leaf quality is adversely affected.

Harvest.

Perhaps in the selection of leaf that has reached a desirable degree of ripeness the most common fault of growers is to be found. Too frequently under-ripe leaf is included in the barn, and the cured colour of the whole more or less spoilt while waiting for it to yellow.

Inability to recognise the change of colour to ripeness is sometimes due to colour blindness, a failing especially in gradations or shades of colour that is not very uncommon.

Growers should recognise that the lowest leaf on the plant, which is also the oldest, will invariably be riper than the one immediately above. At times a leaf further up the plant, above known unripe leaves, will show a tinge of yellow or be pronouncedly so in one part. This does not signify ripeness, but is the result of an impediment in the fulfilment of its function due to broken veins or midrib, a grub in the latter or in the stem near the junction of the leaf; it may be also due to disease. Such a leaf should not be included in the cure. Under-ripe leaf, no matter how well treated, possesses a characteristic aroma which cannot be disguised. Its presence is easily detected by a buyer and a lower price is offered or purchase declined.

When picking, if doubt is felt regarding ripeness, the leaf should be left. Following this course few leaves will be found over-ripe at the next picking, but their loss will be more than counter-balanced by the better price received than if under-ripe leaf was included.

Experience is the only sure guide to a recognition of ripeness. By marking doubtful leaves and observing their behaviour from day to day a perception of ripeness is most easily attained.

Ripeness in coarse or heavy leaf, due to low topping or growth too late in the season, is indicated in a brittleness of the leaf, of which the tip curls downward and the edges frequently inward. Folding part of the leaf under and flattening with slight pressure, ripe leaf will show a clear break. Folded upward unripe leaf will crack across but the break will not extend to the surface cuticle.

Leaf of this character is best cured by itself, but if there is insufficient to warrant the use of a barn for the purpose, it is best strung separately and placed out of sight on the top tiers of the barn.

Care in handling leaf at all times is most desirable, since broken stems are conducive to lower prices.

Curing.

Faults in curing are many and varied; heats are most frequently raised too slowly and at times too quickly and over-ventilation is often a cause of poor colour and sponging.

In raising the heat it should be recognised that the atmosphere is heated more quickly than the leaf, hence the necessity in the earlier stages for the rise to be not more than $2\frac{1}{2}$ degrees in the hour, with usually a pause after every 5 degrees rise.

Following the instructions for the cure of light, medium, and heavy leaf in "Tobacco Growing in Queensland" most growers have obtained satisfactory cures. Few, however, have kept records of each cure or made notes on the behaviour of leaf during the process. No hard and fast rules can be laid down, but if access of colour, hardened tip, shrivelled end, curled edges, dried web, and later veins are recognised as guides for rise of temperature and alteration of ventilation, good results must follow.

Notings of behaviour in one cure can be expected to influence betterment in others following. Faults in ventilation were chiefly in an excess both top and bottom.

An extreme instance of this was noted where a 16 by 16 feet barn was provided with eight rabbit-hutch type of bottom vents, two on each side, each 30 by 12 inches, making the total area of opening 20 square feet. The top vent along the full length of the ridge was 16 by 2 feet representing 32 square feet. The grower, who experienced much sponging during a lengthy period of cure, expressed the opinion that a better result would be obtained if the whole of the roof could be removed. Needless to state the consumption of firewood per cure was also excessive.

In the instructions for curing, the amount of ventilation is suggested as an inch or so, a quarter, a half, and full, but when the area of the vents is not in accordance with that approved under Flue-curing Barns in "Tobacco Growing in Queensland" the terms are apt to mislead.

The actual amount of ventilation required is hard to determine as it varies with the fullness of the barn and the body of the leaf therein.

It has been calculated, however, that a superficial top vent opening equal to $2\frac{1}{2}$ per cent. or one-fortieth of the floor area of the barn with a provision at the base equal to half that on top is usually adequate.

This would mean that in a 12 by 12 by 16 feet barn the top vents when fully open would represent a superficial area of 3·6 feet or 518·4 inches—say, 4 square feet. Those at the bottom would be 1·9 feet or 259·2 square inches—say, 2 square feet, which is half that on top.

In a 16 by 16 by 16 feet barn the floor area would be 256 square feet, one-fortieth of which would mean 6·4 square feet—say $6\frac{1}{2}$ square feet—as full ventilation on top and 3·2 square feet—say $3\frac{1}{4}$ square feet —as full ventilation below.

In erecting barns it is usual to install a sufficiency of top ventilation on each of the two sides of a gabled roof or on each of the four of a hipped roof so that the vent or vents on one side only, opposite to the direction of the prevailing wind, would be used when curing.

Bottom ventilators are usually placed two at the back and two at the front of the barn to allow of additions being made thereto and similarly used. Two or the whole four may be used, but the amount of opening given should not collectively exceed that suggested.

Where the air on entering the barn comes in immediate and close contact with the hot flues a great advantage is gained.

Excessive ventilation is mainly responsible for sponged leaf. When the top vents are too large the temperature at the higher tiers is much reduced. With too much bottom ventilation the ascending air is not evenly heated.

Where top vents are open in the direction of the prevailing wind, a fault of not infrequent occurrence, the outward flow of used air from the barn must be hindered and cold air enter. The result is a delay in the cure with deterioration of colour.

The heating system also in many barns is capable of much improvement.

Bulking.

Occasional instances of the inclusion of fat stems and of leaf being bulked with too much moisture have been noted, followed by neglect to examine condition periodically, especially after a fall of rain. As a result darkening of colour and even moulding have occurred.

A good plan is immediately on removal from the barn to bulk the leaf down on the sticks and to cover the bulk for a day or longer before taking it therefrom. This will necessitate a double set of sticks for each barn and somewhat more space in the bulkshed. Advantage will be found in a greater evenness of condition and the opportunity to roughly grade the leaf into Bright, Medium, Dark, and Green, with more certain exclusion of fatty stems. This expedites and reduces the cost of subsequent grading for sale.

Grading.

The grading of leaf on the farm is commended as the grower thereby gains a better idea of quality and is impressed with the directions in which improvement is most desirable.

As a general rule, home grading has been approved by buyers. There is perhaps a tendency to make too many grades, a fact which is reflected in a number frequently realising the same price when sold. This, however, is to be commended rather than condemned as it will be righted as experience is gained.

In grading, colour only is most often the only guide followed. Body and damage should also be considered. Papery leaf is of less value than that of medium body, likewise boardy leaf is inferior to that with good elasticity. Even though colour may be uniform, diversity in other directions can be expected to adversely influence price.

Where a uniform growth is made each picking is of leaves occupying practically the same position on the respective plants and is mainly uniform. When each cure is roughly graded before bulking, those from the different pickings can be kept separate. This practice will not only facilitate grading for colour but also for size and quality in other directions. Broken stems are anathema to the buyer as cost of handling at the factory is thereby increased. They should be graded out and baled as scrap, for inclusion with whole leaf lessens the offer.

Handing.

Hands frequently carry too many leaves and are unduly large, while ties as a rule are far from neat.

The grower is known by his product so, when grading is done on the farm his care or otherwise, therein, becomes known to the buyer whose offers of purchase are correspondingly influenced.

E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

PART II.

THE MIDDLE WHITE.

PURE white in colour, of a conformation similar to that of the Berkshire, and having unique qualifications as a breed specially adapted for the production of pigs suited to the pork trade, the Middle White—still referred to frequently as the Middle Yorkshire, the Mid-White, and the Medium York—is without doubt one of the breeds in which pig raisers in this country should be especially interested.

British in origin, its home in the heart of Yorkshire, England, it has an historical record like that of the Large White, full of interest especially to those who like to delve into records and try to get back to the beginning of things. Possibly it is difficult to indicate with any degree of certainty just where and when this well-known breed had its actual beginning. Doubtless it originated among those of our forefathers who, as stockmen, instead of depending upon a more weighty, growthy, and mature pig preferred to make a selection from available stocks of a type more blocky in stature and conforming particularly to the peculiar requirements of the pork butcher than whom there was no more particular connoisseur associated with the meat world.

Originally there was but one Yorkshire breed, a popular and profitable animal, the product of selection from types developed following the introduction into Great Britain of the Chinese type, and its use in grading up from the original wild hogs of Yorkshire and Lancashire.

Early History of the Middle White.

In 1860 prominence was first given to the qualifications of this type of Yorkshire pig, and about the same time they were first brought before the public at stock fairs and village shows. Three distinct offshoots from the original parentage had thus been developed, the Large White, whose history was traced in the August issue of this Journal; the Middle White, with which we are at present concerned; and the Small White, to which reference is made later in these notes.

It is of interest to note that the Middle White has, all along, maintained its place in the pig world, because of its docility, prolificacy, prepotency, quick and easy growth, and adaptability—breed characteristics no less valuable in these days of keen competition than they were in those far-off days when farmers knew but little about breeds of pigs.

Notable among early breeders of this type were the Wainmans, whose boar, "Lord of the Wassails," was the first male of the breed to win a prize at the Royal; they were prominent fanciers of this type for many years after that. Then followed the Harrisons of Stockport, the Duckerings, Collinsons, Mangles, Peter Eden (who owned a sow, "Gem," which produced seventy-four pigs in six litters), the Stricklands, the Earl of Ellesmere, Sir Gilbert Greenall, Ashford of Rufford, the Twentymans, and in later years among a host of others, the venerable Sanders Spencer of Holywell, whose name will for ever remain associated with progressive stock raising in the nineteenth century.

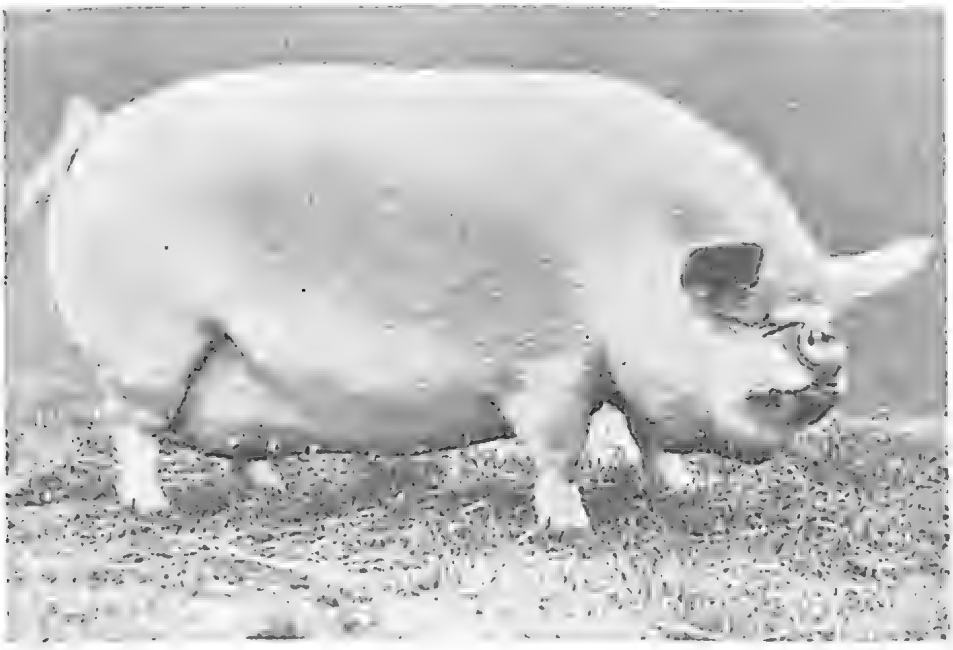


Plate 154.—Middle White Sow.

This prize-winning Middle White sow protrays type, conformation, and quality, such as is sought for in this popular breed.

Mr. J. T. Eady reminds us in his interesting review of the breed in the 1934-35 Pig Breeders' Annual that so successful was Sanders Spencer that his herd won in five years 339 prizes amounting in cash to £1,400, and after an interval in the second five years, 401 prizes totalling £1,600, a reminder that there was plenty of money in pigs even as far back as the 'sixties. The success attending his efforts naturally spurred other breeders on, and in rapid succession came the development of such well known families as the Holywells, Histons, Pendleys, and Wharfedales, of whom representatives have on several occasions been imported to Australia. Mr. Eady also reminds us that

although Sanders Spencer has gone, the Middle White breed will remain a testimony to his life work, that will last for all time, and keep his memory evergreen. The Walton herd of the late Sir Gilbert Greenall played its part, and had a great influence on the breed, and was prominent for many years. Such names as "Walton Rose," "Walton Daisy," and "Walton Turk" occur and reoccur many times in the history of many Middle White families of to-day, so also does the Wharfedale Reveller family, Wharfedale Deliverance, and Pendley Choice. Prominent also was the late Leopold Paget, whose death only quite recently was a sad blow to this breed. Representatives of the Histon herd of Chivers & Son have had an important part in the breed's more recent history; in fact, one sow in particular, "Histon Lady Choice," sold for the English record price of 180 guineas some twenty years ago or so.

PLATE 155.

Champions at the Royal Show, Sydney, 1934, this pair of Middle Whites illustrates the type available here. The boar carries a heavy coat, and is somewhat coarse and curly in hair. The sow is more refined, and has a particularly well-developed set of udders.

Another breeder whose name is well worthy of a place in this list is Arthur Hiscock, whose family did a great deal to popularise the Middle White breed.

Prominent among the breeders who were interested in this breed in Australia in the early days of registration here are included: Mr. J. J. Baker; Dookie Agricultural College (Victoria); Hawkesbury Agricultural College and Gladesville Hospital (N.S.W.); Messrs. E. Jenkins, F. E. Kurrle, Chas. Jones, Peter Miller, Jno. Madden, S. A. Peck; Queensland Agricultural College, Gatton (Q.); Messrs. W. J. Warburton, and W. R. Robinson.

In those days the Large White had fewer followers than now, but it can be said in all fairness that the Middle White led the way in the earlier years of pig improvement in this country.

Special Qualifications of the Breed.

Fostered by the National Pig Breeders' Association in England, and the Australian Stud Pig Breeders' Society in Australia, the Middle White has gained for itself a place of importance in the pig industry.

The Middle White ranks with the best of other breeds, indeed it probably excels the others as a breed suited to the production of

porkers, for there is no quicker feeder than the Mid White for production at an early age of the light weight prime quality carcasses nowadays so much in demand locally and overseas. It is in addition an excellent butcher's pig, dressing out to advantage with a minimum of offal and an attractive, neat, lengthy carcass. With other breeds it has improved appreciably in its suitability for the production of baconers, the typical carcass having good length, depth, and a reasonable proportion of lean meat.

For porkers it approaches the ideal in the pure bred form. It is useful also for crossing with the Berkshire, while crosses with breeds like the Tamworth increases the proportion of lean meat and produces a light coloured animal much in demand; although in such a cross as the latter, care must be taken that the young pigs do not become too leggy and lean before being finished for market.

PLATE 156.

Though somewhat more compact and of blocky stature, this Middle White sow shows plenty of quality and is well developed and roomy in body, and has proved a profitable addition to her owner's herd.

The breed ranks high in prolificacy, 1,638 litters recorded in 1932 (in England) giving an average born per little of 9·55, with an average reared of 7·57, as against the Wessex Saddleback, which topped the list with a reared average of 8·12. The writer's experience is that, if given a reasonable chance and kept in medium breeding condition, the Middle White will easily eclipse the English figures under Australian conditions. A special characteristic of the Middle White is its docility, the sows in particular being exceptionally docile and careful with their young. They are liberal milkers, and the young pigs grow rapidly and are of attractive type at an early age, points of especial importance in preparation of stock for market. Being docile naturally indicates that the breed has an even temperament, and settles down quietly to its environment.

PLATE 157.

"Norfolk Poppy 3rd," 4609, Champion Middle White sow, Brisbane Exhibition, 1934. Shown by Mr. J. J. Slack. This sow is a daughter of the imported "Anport Fuchsia, 9th," 4192, a sow of excellent type and conformation with noted prize-winners in parentage. Note feminine characteristics and capacity to suckle and rear large thrifty litters.

Good constitution, a well developed heart girth, withal a light shouldered type, there is no reason why Middle Whites should not be suited to conditions on any farm. The fact that the breed is kept extensively under open air conditions in colder countries has proved its capacity as a grazing animal. Even in warmer climes it can stand up to extremes in temperature without undue distress—another evidence of its suitability for Australian conditions where open air systems of pig-raising are becoming more popular each year.

Breeders in Queensland who have tried the Middle White under these conditions report success. The late Mr. W. J. Warburton, of Northgate, had this breed for many years prior to the general adoption of a paddock system; so did the late Mr. W. R. Robinson, who claimed to have been the first to introduce this breed into this State.

In England many of the leading breeders keep their pigs out-of-doors throughout the year, even during winter months, with snow on the ground. In more recent years breeders like Messrs. Pope and Sons, of Nambour, Dinmore Stud Piggery, G. W. Winch, of Zillmere, and others have kept their Whites under a semi-intensive system, permitting the animals to remain in the open air as long as they wish, providing suitable shelter sheds or shade trees as required. Breeders in North Queensland, Messrs, J. E. Foxwell, W. J. Sloan, and others report similar success.

Early maturity is another special qualification of this breed; in fact, the National Pig Breeders' Association emphasise the breed's claim to distinction by its success in pork carcass competitions at Smithfield and Birmingham Fat Stock Shows. They state that the Middle White, in common with other breeds enjoying similar status, has proved itself to be an excellent pig for the farmer who prefers to crossbreed, and whose objective is early maturing pigs for the pork market.

The breed possesses prepotency by virtue of long continued registration and its suitability proved by many years of experience for mating with strains lacking in this respect. The breed can be used to advantage for crossing with pigs lacking the same qualifications, and where early maturity, trueness to type, and even conformation are desired; especially is this so in regard to the use of this breed in the production of uniform quality porkers for the frozen pork trade. The advantage the breed possesses in stamping its white colour on its progeny should not be overlooked in considering the selection of stock for use in this branch of the industry.

Refinement of quality is a goal towards which all pig raisers should aim, and in this direction much can be done by the use of a breed noted for its refinement and trueness to type.

Queensland experience indicates that the White breeds have come to stay, and that they can be used to advantage in the building-up of an expansive export trade.

The general recommendation of officers in the Pig Section of the Department of Agriculture and Stock is to use the Middle White boar where good type Berkshire, grade or first cross sows of similar type are available, and/or to use Middle White sows as matrons in the herd, and to use either a Middle White or a Berkshire boar. Some emphasis has been given to the value of the Middle White-Tamworth cross, and

the cross where sows carrying British Black blood are available. It is noteworthy that at the first of the series of annual carcass contests conducted by the Queensland Meat Industry Board, Middle White pigs or their crosses secured the premier awards.

If one point might be stressed more than another in dealing with the Middle White breed, it would be to urge the necessity for special attention in the selection of breeding stock to obtain lengthy deep-bodied pigs with a heavy coat of silky hair and with a pinkish skin free from blue or black spots or freckles as far as this is possible. Any strain showing a tendency to shortness and chubbiness of body and to overfatness should be discarded. Select only from large, thrifty litters, and be certain that both boar and sow, the latter particularly, have twelve, fourteen, or sixteen well-developed permanent teats evenly distributed along the belly line. Any indication of coarseness in bone, rupture, or other abnormalities in breeding organs or lack of sufficient hair to protect the skin should be guarded against. Selection of the proper type and their care and attention along approved lines will overcome any tendency this or the Large White breed may have to suffer as a result of the warm climate.

STANDARD OF EXCELLENCE

For the Middle White breed as adopted by the Australian Stud Pig Breeders' Society, 1934.

	Points.
Head and Ears—Short and light, wide between eyes and ears; face slightly dished; ears medium, carried erect or slightly forward, and fringed with fine hair	15
Neck and Shoulders—Medium length, evenly set on shoulders; jowl full, but not heavy; shoulders well sloped backward, and free from coarseness	10
Back and Sides—Long and straight; loin full; ribs well sprung, sides deep and full to flank, showing straight underline; and in sows, twelve good, evenly-placed teats	20
Hams—Broad, full, and meaty to hocks; tail set high, not coarse ..	20
Legs and Feet—Short, straight, and strong; feet firm and strong; hoofs nearly erect; action free and clean	15
Colour, Skin, and Hair—White, free from black spots; skin fine and free from wrinkles; hair long, plentiful, and fine and silky	10
Character—A combination of all the points showing distinctive breeding, type, and quality	10
	100

THE SMALL YORKSHIRE.

Many years ago the Small Yorkshire was prominently before breeders in the Homeland and in this country, but at the end of the nineteenth century this and several other breeds of similar type had lost ground and the Small York and the Small Black (often referred to in Australia in these days as the Black Essex) in particular have disappeared altogether, and nowadays are not bred to any extent in any part of the world.

The reason for their decline was their unsuitability for the warmer climatic conditions of Australia. Any advantage they possessed and the breed qualifications have been improved upon and commercialised in the Large and Middle White breeds, which in themselves have been bred more along commercial lines in recent years.

At the Brisbane Show.

NOTES ON THE PIG SECTION.

By E. J. SHELTON, H.D.A.

THAT the periodical introduction from countries overseas of fresh strains in the different breeds of pigs is productive of good needs no greater emphasis than mention of the success of imported stock at the recent Royal National Association's Exhibition at Brisbane, Queensland, at which there was a very comprehensive and valuable display of stud and commercial pigs. The judges in the stud pig classes were Mr. T. J. Collins, of the State Hospital, Newington, N.S.W., a man well versed particularly in the Berkshire breed; and Mr. A. F. Gray, New South Wales Government Instructor in Pig Raising.

Berkshires were prominently represented, and created a very favourable impression; in fact, the senior animals in this breed were almost without equal at any Australian Show.

PLATE 158.

"Grafton Trump." Messrs. M. Porter and Sons' Reserve Champion Berkshire boar. R.N.A. Exhibition, Brisbane, 1934; also Championship winner, Wondai and Murgon. "Grafton Trump" was bred at Grafton Experiment Farm, New South Wales, from imported strains, is the sire of many Champions and prize-winners.

"Yanco Boscer," 11686, bred by the Riverina Welfare Farm, repeated his success at Sydney Royal, and carried off the breed championship and Herd Book ribbon. Since his purchase by Mr. J. Barkle for Queensland after last Sydney Show, he has secured championships at Toowoomba Royal (in keen competition there as well as at Brisbane), Oakey, Dalby, and Kingaroy, the only shows at which he was penned. This is a very fine son of "Navua Chamelion," having as his dam, "Yanco Beautiful." The reserve champion boar and last year's champion in same class was "Grafton Trump," 10722, owned by M. Porter and Sons, Wondai. This boar was bred at

Grafton Experiment Farm, and is a son imported in utero of "Pygmalion 5th," 10127, from "Highbury Fair Lady 2nd," 10126. He is a very fine representative of the latest British type.

A son of his, "Roselock Trumpet," 11374, bred by M. Porter and Sons, Wondai, and exhibited by the Wide Bay Stud Piggery, annexed the third award. He also has won championships at other shows, and like "Grafton Trump" is well known. The other ex-champions in the same class were "Caralulup Harry," 10020, bred in Victoria, and a champion at a number of Queensland Shows; "Goodna Aviator," shown by Goodna Hospital, and a prize winner of note; "Cawdor Happy Lad," 11603, champion at the recent Ipswich Show; and "Gatton Premier," who has worn prize ribbons on many occasions.

Several boars and sows were shown by Mr. F. Bach from his "Whipling Amelia 2nd" (imp.), 12103, and again brought forward imported strains of much value.

PLATE 159.

"Roselock Lila." Mr. Mat. Porter's prize-winning sow. Champion, Brisbane 1932; First and Reserve Champion, 1931. Reared litter of nine out of twelve. Exhibited Brisbane Exhibition, 1934. A fine type of breeding sow.

The imported sow, "Linton Patience," 12102, bred from "Bridge Poppy," 11504, and sired by "Hillsborough President," 3519, at the stud of S. C. Armitage, Linton Fields, England, secured the premier award in the female classes, and also first award in sow and litter class, in which there were several nice families. She secured the Herd Book ribbon, and in some measure repaid Mr. Bach for expense incurred in importing his two sows. "Whipling Amelia" secured first prize in a keenly competed class, and most of the breeders considered she should have been awarded the reserve, an honour that fell to Mr. O. L. Klein's entry, "Kapleton Dora," 11036. The Berkshire sows were a very fine lot. Last year's champion, Mr. Mat Porter's sow, "Roselock Tessie," was this time shown with a fine litter of twelve and secured second in that class, and third in the class for sows over 21 months. There

were approximately 175 Berkshire sows, and it was remarked there were no tail enders.

Large Whites.

The champion Large White boar, shown by Gatton College, again brought forward imported strains, for he, "Norfolk King David 5th," 1687, is a son of the imported "Wall King David 14th," 953, from that fine sow, "Spalding Baroness 11th" (imp.), 951. The reserve champion boar is a son of "Wall King David 48th" (imp), from Hon. T. H. Paynes' Woodburn Stud in Victoria, who imported several prominent animals from England. Other interstate studs represented among the prize winners included the Finchley and Vaucluse herds in Victoria, the Queensland Agricultural College and High School stud at Gatton, Queensland, in which there are also several stud animals from the Southern States, and the stud of J. A. Heading, of Murgon. Mr. Heading has New Zealand strains in addition to those from Victoria; in fact "Pine Terrace Pear" (imp.), 1220, carrying Canadian blood, annexed the female championship and Herd Book ribbon, while the

PLATE 160.

"Roselock Tessie." First and Champion R.N.A., Brisbane, 1933; third prize winner, 1934. Second prize with litter of twelve, Brisbane, 1934. First Wondai, second Murgon, and Maryborough, 1934. A classy sow and a proved mother. Owner, M. Porter and Sons, Roselock, Wondai.

reserve champion is a granddaughter of imported parents. "Norfolk Bonetta 4th," 2011, another daughter of the imported "Wall King David 14th," carried off first prize in her class with litter. A daughter of "Spalding Superior 21st" (imp.), 2098, by "Tockwith Prince George 37th," 77923, was a very close runner-up for first place in her particular class. Approximately 90 Large Whites were penned, easily the largest and most exemplary display of stud animals in this breed yet penned north of Sydney.

Middle Whites.

The progeny of imported blood secured the five principal awards in the Middle White breed, the champion boar, "Norfolk Defiance 3rd," 4596, a son of that grand old boar, "Norfolk Nobleman," 3993 (last year's champion) ex "Norfolk Fuchsia 2nd," 4407, being a typical

illustration. He was shown by Mr. J. J. Slack. The entry of Mr. G. W. Winch, "Ferndale Victor," 4807, from the stud of I. M. Cash and Sons, in Victoria, secured the place of reserve and second in the aged class, and is a son of "Dookie Moral," from "Ferndale Pearl," a prize winner of note, like her sire and his stud. Mr. J. J. Winterbottom's stud secured a place with a boar penned by Mr. J. J. Slack. This boar was first in his class at Sydney, and had to face even keener competition at Brisbane, where he had to be content with third place. Mr. Cash's stud was represented also in other classes. Mr. Charlish's stud came in for much comment when "Norfolk Poppy 3rd," 4609, won the championship and Association's ribbon. She is a daughter of "Amport Fuchsia 9th" (imp.), 4182, and had as a very close runner-up the reserve sow, "Norfolk Bonnie 1st," 4588, a daughter of "Pendley Deliverance" (imp), 4190, an imported sire who has done much for the breed in this country.

Queensland urgently needs fresh strains, however, in this and the Large White breed, in order to maintain type and conformation and keep the breed up to its highest standard. The showing of Middle Whites was the best staged at Brisbane for at least fifteen years, and indicates the progress being made. It is of additional interest to note that a boar offered for sale by Mr. Cash realised highest price at the sales, 22½ guineas, and a sow sold by Mr. J. J. Slack at 19 guineas topped the prices for sows in all breeds offered.

Tamworths.

Mr. A. F. Gray judged the Tamworths, Wessex Saddleback, and Middle Whites, while Mr. Collins handled the Berkshires and Large Whites. Mr. M. Moffatt, of Billinudgell, annexed the male championship in this breed with a son of that very fine imported sire, "Whittingham Red Start," 1366, the boar being bred at Wollongbar Experiment Farm, New South Wales. It would be but fair to say that these imported strains have exercised a very considerable influence for good in the pig-raising industry in Australia, especially as the bulk of our prize-winners carry imported blood in their veins, and most of it imported within the last ten or twelve years.

"Wattledale Sandy," shown by Mr. J. Barkle, won a very well-merited reserve ribbon; in fact, he was quite good enough for the premier award, and in much better breeding condition, although the champion was in better form in that respect at this than at former shows. A son of "Milton Luck 3rd," imported from "Berkswell Constance 15th" (imp.), 1798, shown by Mr. H. B. Kerner, was placed.

That "Berkswell Constance 15th" (imp) is a good importation is again proved by the fact that her daughter, "Warringal Precocious," 1924, sired by "Milton Luck 3rd," won the championship in female classes, and was generally regarded as the best sow that has yet been shown in this breed at any Australian Show. Mr. Barkle also secured the reserve Tamworth sow championship with his "Wattledale Queen," sired by "Glenburra Bill," a champion of former days. "Warringal Carnation," 2159, a daughter of "Berkswell Constance" by "Baulking Golden King" (imp.), 1800, was also penned. There were approximately 80 Tamworths penned, comprising a very attractive selection, and emphasising that we have in Australia some of the best Tamworths in the world.

Wessex Saddlebacks.

Imported strains again came to the fore in this recently imported breed, the champion sow being "Holmsleigh Ace" (imp.), 2, bred by H. Losmore, of Devon, England. A son of hers, sired by "Holmsleigh Pioneer" (imp.), 1, secured the championship in the male classes, while progeny of these and others annexed important awards, the imported sire, "Holmsleigh Surprise" (imp.), 10, being runner-up for championship, and "Maiden Beech Ringouzel 9th" (imp.) annexing that position in the female classes. Although sons and daughters of these imported parents were shown in larger numbers than at former shows, there is as yet an insufficient number of animals available in this breed to enable it to make much progress or to demonstrate its capacity to produce and rear large litters. Mrs. A. Alford, Mr. R. Turpin, and Mr. C. F. Marshall were the only exhibitors.

Further comments and pictures of prize winners in the Pig Section will be published in the next issue of this Journal.

A GATE THAT WILL NOT SAG.

A Southern farmer supplies an agricultural paper with this splendid idea for a gate that will not sag. Thus he writes:—"Before sawn timber got plentiful in the backblocks, various were the styles of gates. Every owner seemed to have a different style, and some of them were very ingenious. Where timber is plentiful, and particularly in the mulga country, the following, I think, will be useful:—

"Cut a limb or two with a protruding fork in the following shape:—

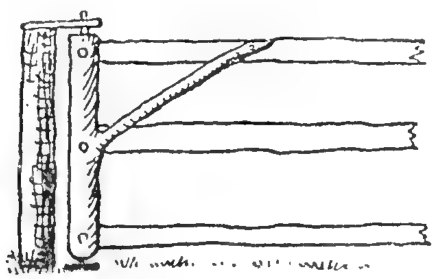


Plate 161.

"It will easily be seen that the fork, being part and parcel of the post, it would be impossible for it to sag. In any road gates I have always used 3 by 1 timber and rabbit netting. Use of the latter saves a lot of weight, and can be easily put in between the battens, which are held together by bolts. I put up a set of drafting yards in the Cunnamulla district in Queensland and, of course, there were the usual number of small gates, and I found this style very effective."

The 1934 Brisbane Exhibition.

PLATE 162.—THE JOURNAL AT THE SHOW.

The "Q.A.J." Information Bureau in the Agricultural Court at the Brisbane Show was the distributing centre of information on Departmental activities—a service much appreciated by farmers visiting the Exhibition. Mr. A. C. Boyle is the young officer in charge.

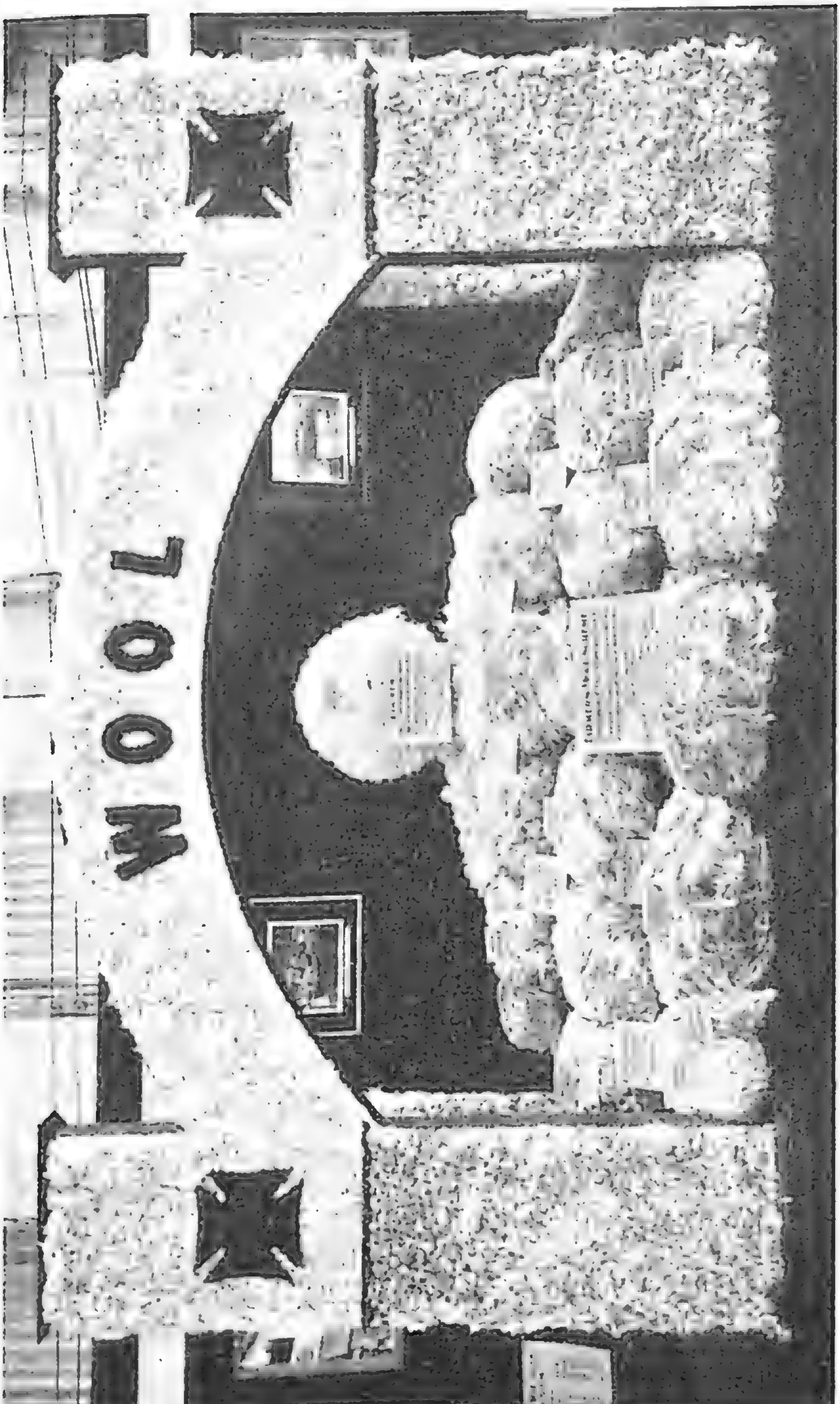


Plate 163.—A Fleecy Emblem of our Wealth in Wool.
Queensland's fine merino wools are unexcelled in any other country.

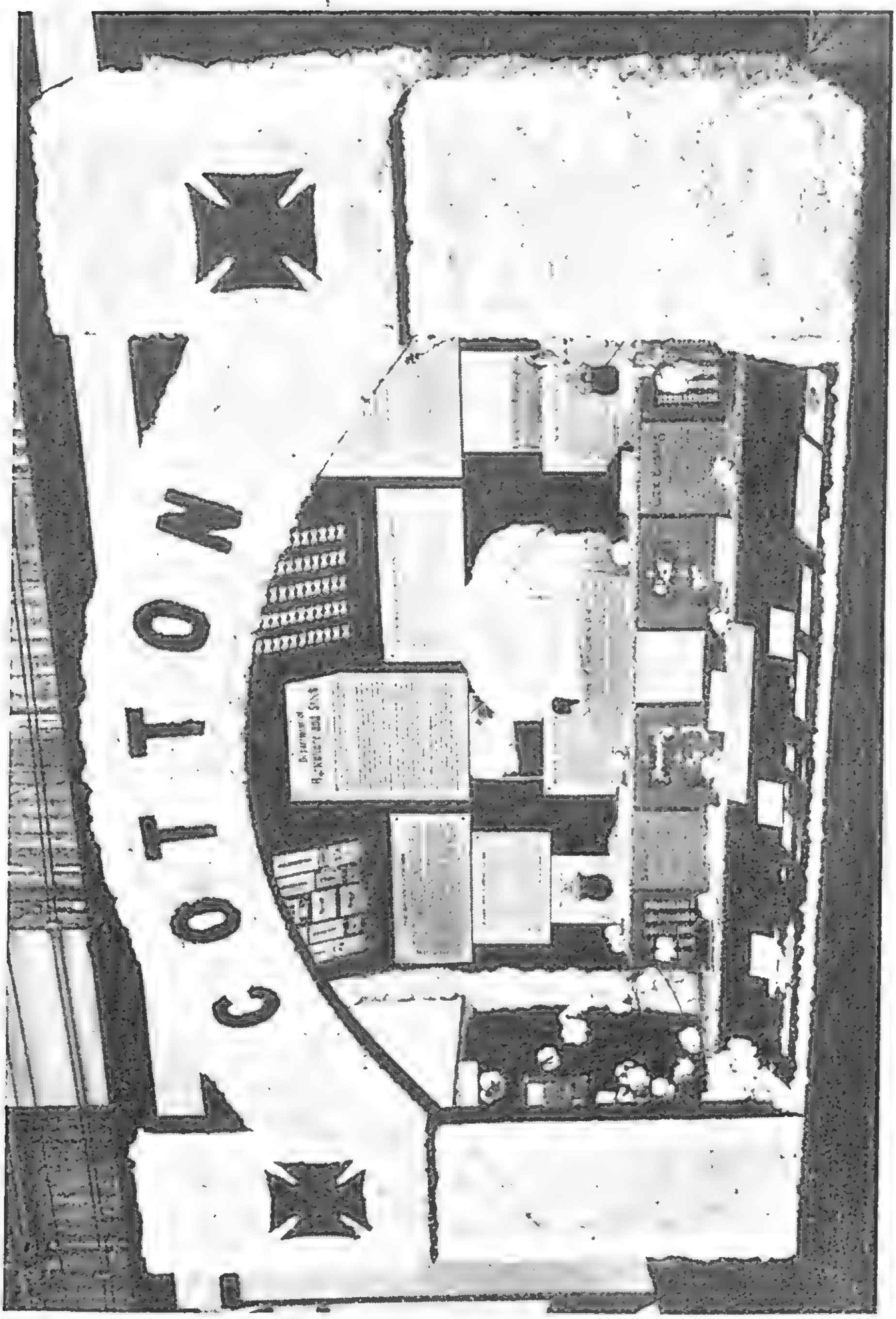


PLATE 164.—QUEENSLAND LINT FOR AUSTRALIAN LOOMS.

Cotton-growing is developing into an industry of major importance, and the spinning industry is already an appreciable factor in the economy of the Commonwealth.

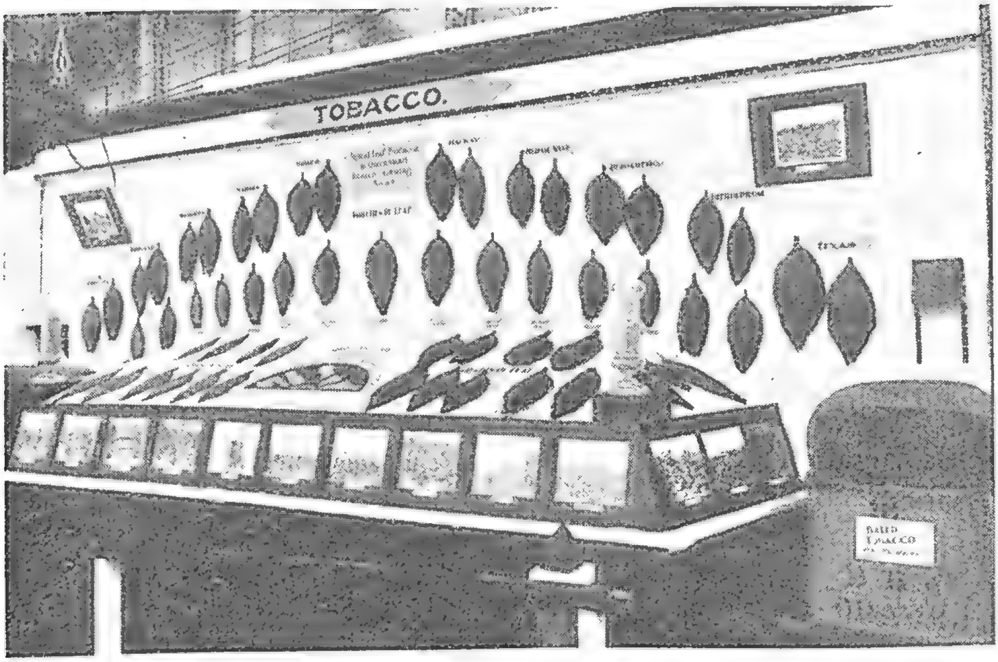


PLATE 165.—QUEENSLAND GROWN TOBACCO AT THE BRISBANE SHOW.

This display of leaf from the State's tobacco lands was definite proof of their capacity to produce high quality tobacco acceptable to manufacturer and consumer alike.

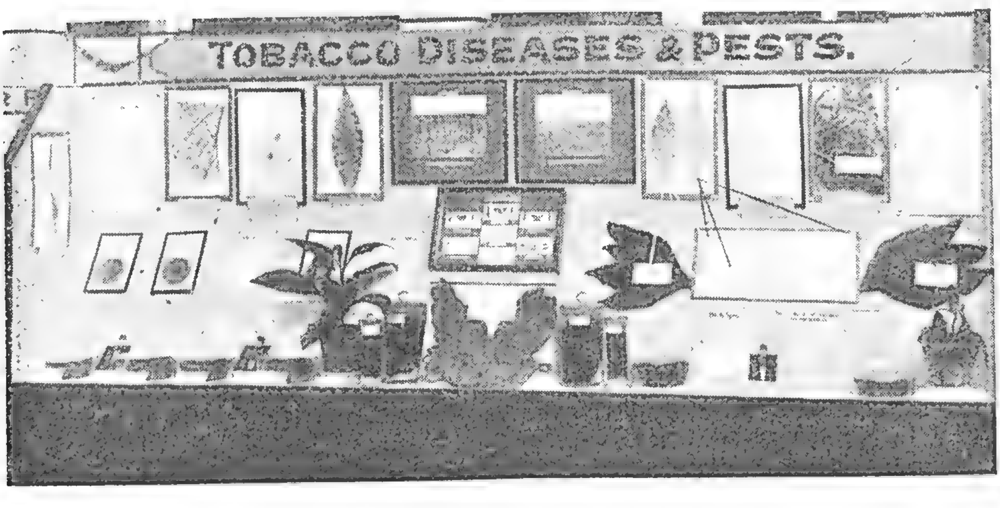


PLATE 166.

The Queensland tobacco grower is well served by the Science Branch of the Department of Agriculture and Stock.

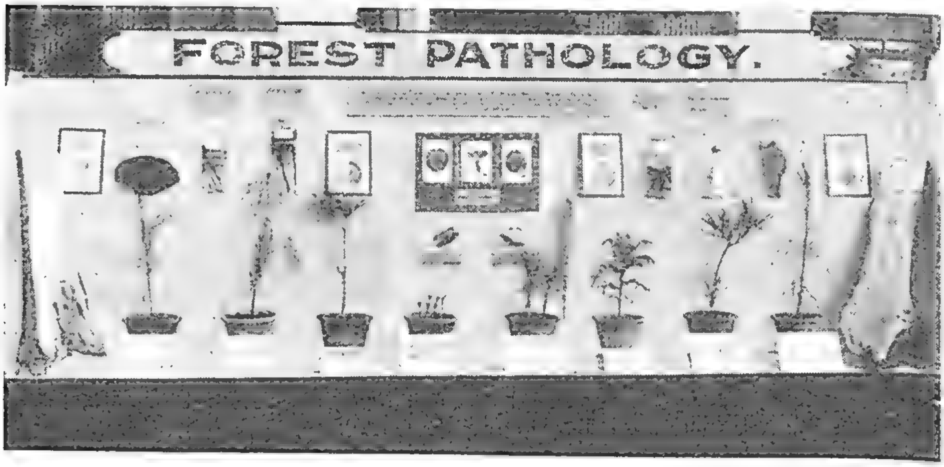


PLATE 167.
An Instructive Panel in the Departmental Court.

PLATE 168.—THE SUGAR BAY IN THE AGRICULTURAL COURT.

Our photographer found it difficult to get an effective picture of this fine exhibit, arranged by the Bureau of Sugar Experiment Stations in conjunction with the canegrowers' and sugar producers' organisations. In the centre section a scale-working model of a mill attracted crowds daily throughout Show Week.

PLATE 169.—AN IMPRESSIVE PANEL OF THE SUGAR EXHIBIT.

In the foreground is a model refinery on a river frontage with wharf stacked with sugar bagged for shipment. A diorama forms the background on which is depicted the spires, domes, and factory chimneys of a great city, to the wealth of which the sugar industry is an important contributor. The panel is also suggestive of the interlinked relationship of rural and urban enterprise.

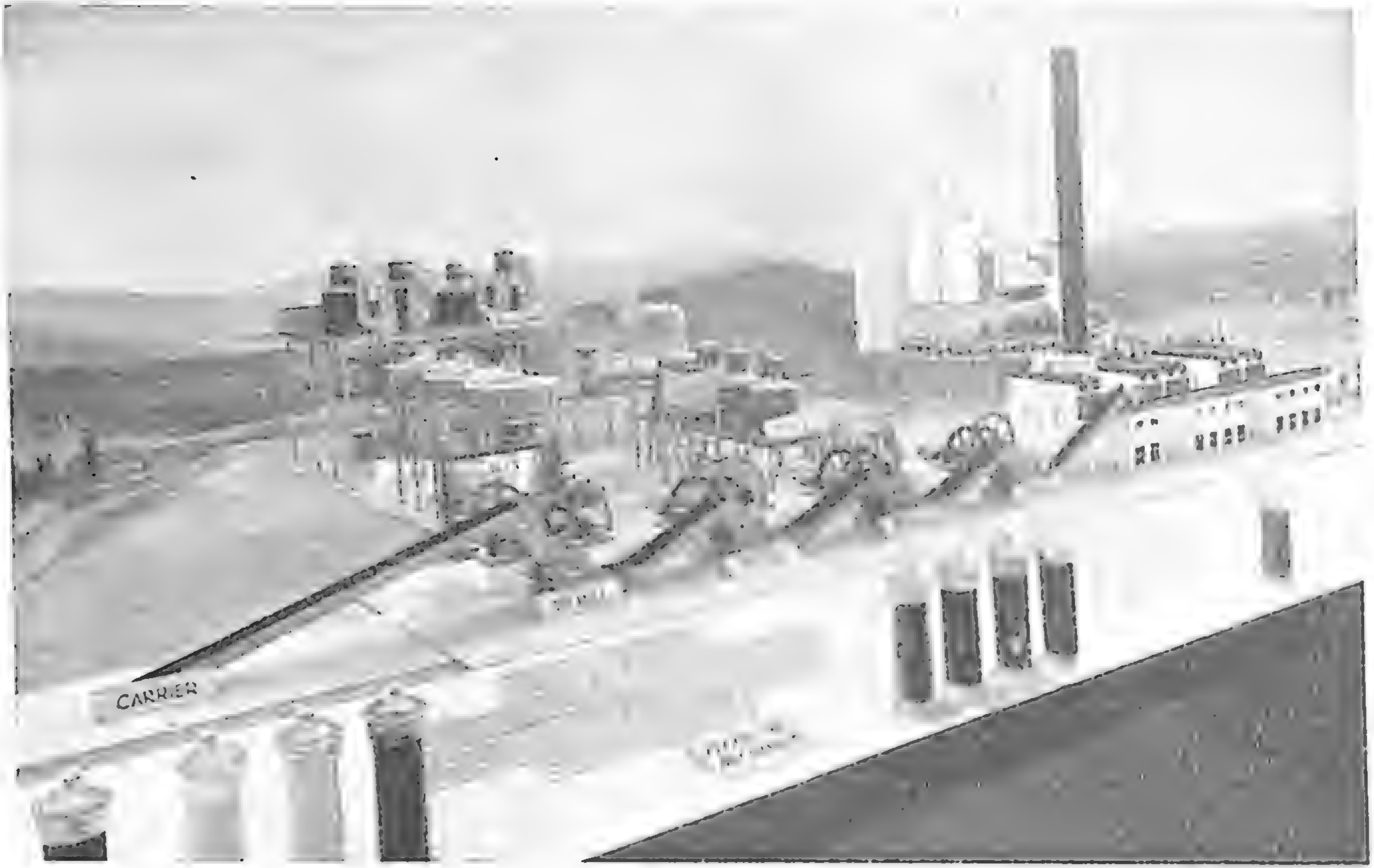


PLATE 170.—A WORKING MODEL OF A QUEENSLAND SUGAR MILL.

This model, constructed to scale and showing every factory operation in miniature, was the centre of keen public interest throughout Show Week. In this and adjoining sections the whole story of sugar was illustrated, beginning with the standing jungle and passing through every phase of farming, to milling and finally to the refinery and bagged and stacked sugar for shipment at the waterside.

Plate 171.—Sugar at the Show.

These stools of standard cane varieties, grown in the Burdekin Delta, attracted keen interest at the Brisbane Show.

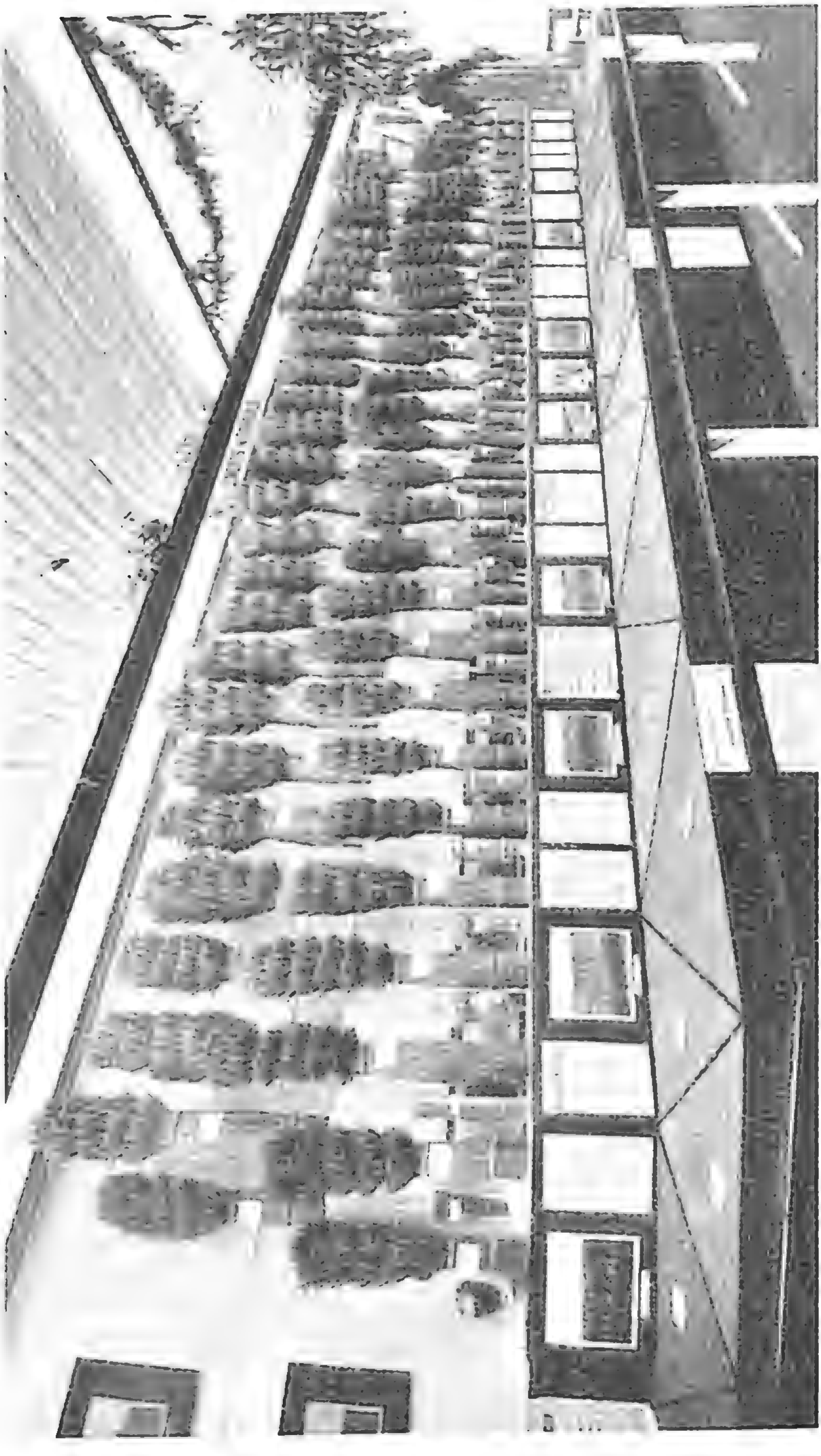


PLATE 172.—A CEREAL STORY IN SHEAVES AND GRAIN.

This interesting panel in the Departmental Court illustrated the success of the plant breeders' efforts to evolve a wheat suitable for Queensland's climatic conditions of summer rainfall.

PLATE 173.—QUEENSLAND MAIZE.

This display at the Brisbane Show was an impressive object lesson in maize breeding and production in this State. It represented the national value of the work of Departmental plant breeders in the evolution and fixation of types that have quadrupled our grain yield. Maize-growing is now one of Queensland's major agricultural industries.

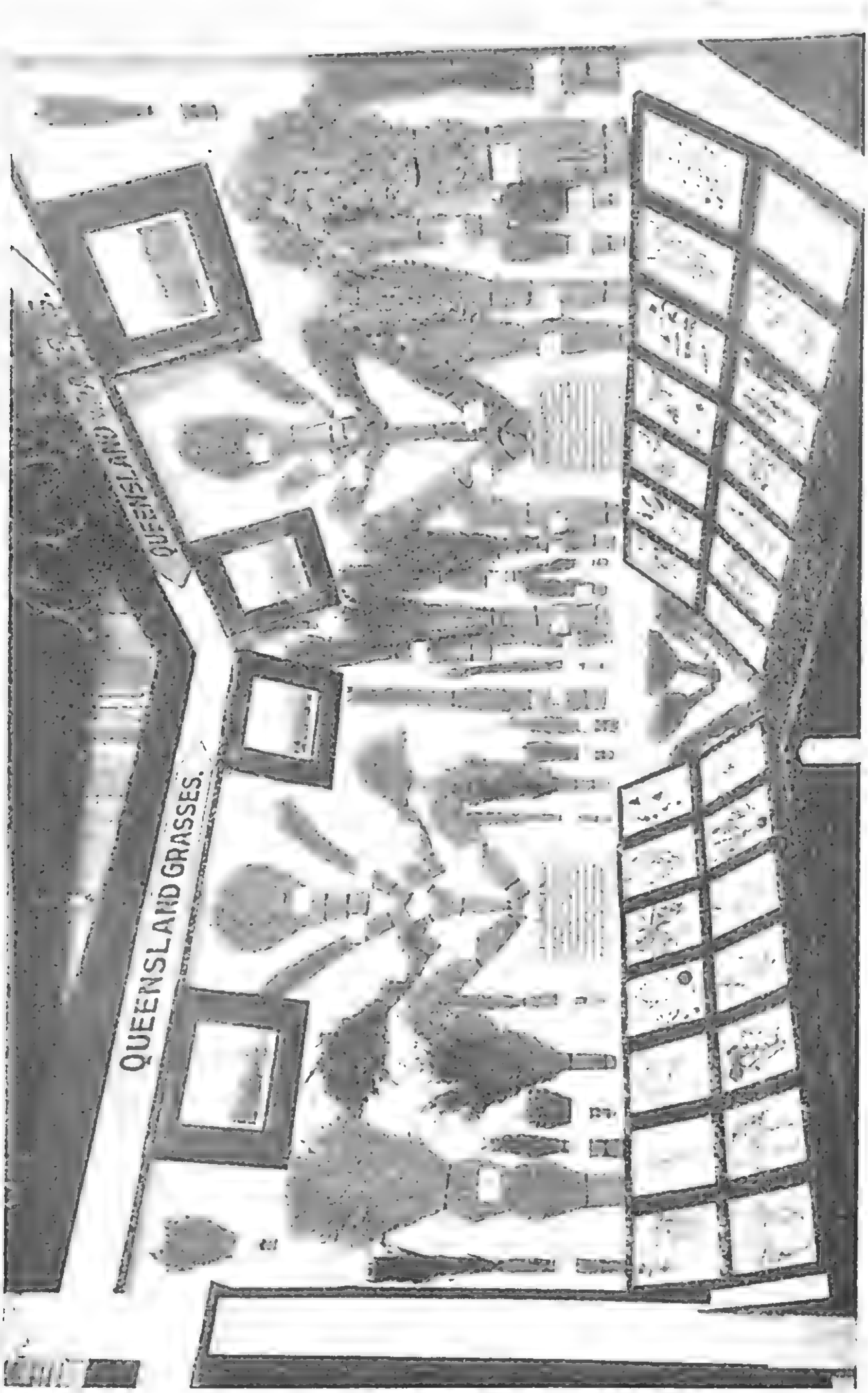


PLATE 174.—ALL FLESH IS GRASS.

These samples of Queensland pastures panelled in the Agricultural Court at the Brisbane Show illustrate the extensive range of nutritious indigenous grasses and herbage from which is derived most of the wealth of the State.

Plate 175.—Fodder Plants Panelled in the Agricultural Court.

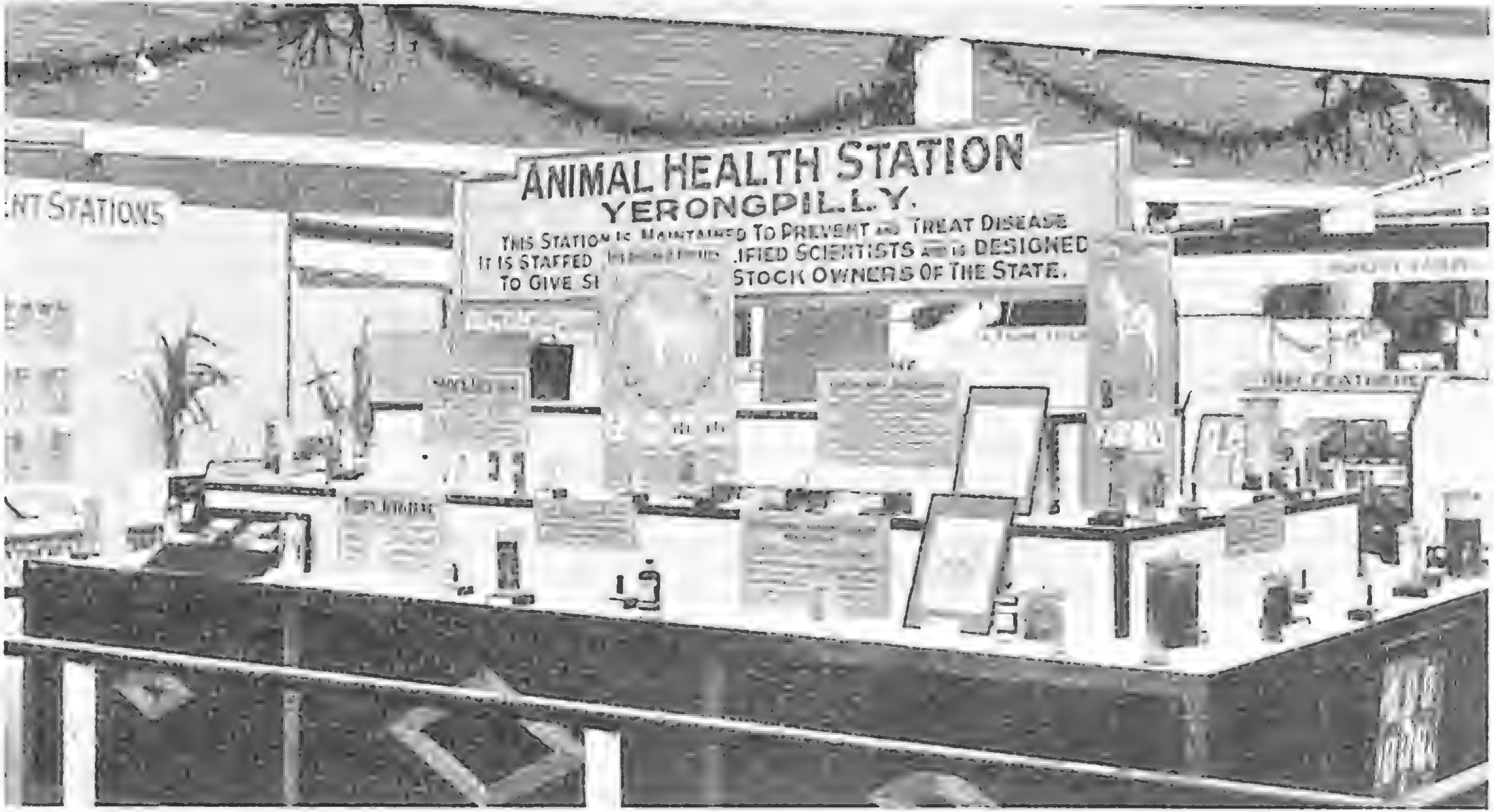


PLATE 176.—IMPORTANCE OF PATHOLOGICAL RESEARCH DEMONSTRATED.

The Animal Health Station is controlled by the Department of Agriculture and Stock, with the assistance of an advisory board consisting of representatives of the Department, the Queensland University, the Council for Scientific and Industrial Research, the medical profession, and grazing interests.

Plate 177.—Science and Agriculture.

This and other exhibits of the Entomological Branch and its Pathological Section was illustrative of the extent and value of the scientific services available to Queensland farmers.

PLATE 178.—FRUITS OF THE CENTRAL BURNETT.

While both temperate and subtropical fruits are produced profitably in the Gayndah District, its citrus groves have won for it the great reputation it enjoys on the markets of the Commonwealth as a great fruit-growing region. This exhibit was awarded first prize in the Citrus Fruits Section with a score of 86¾ points.

Plate 179.—Apples from the Fruitful Granite.

This was the winning exhibit in the apple trophy (20 to 25 cases) class at the Brisbane Show, grown by Mr. C. J. Doyle, near Stanthorpe. The fruit was in excellent condition, competing successfully against exhibits of Jonathans, Sturmers, and Democrats from New South Wales and Tasmania.

PLATE 180.—THE WEALTH OF QUEENSLAND'S TROPICAL PROVINCES.

The producers of the Charters Towers and Mackay Districts combined in presenting this remarkable array of the products of tropical coast and temperate tableland. No finer evidence of the richness of North Queensland in agricultural, pastoral, and mineral resources could be submitted. This exhibit won the "A" Grade District Competition.

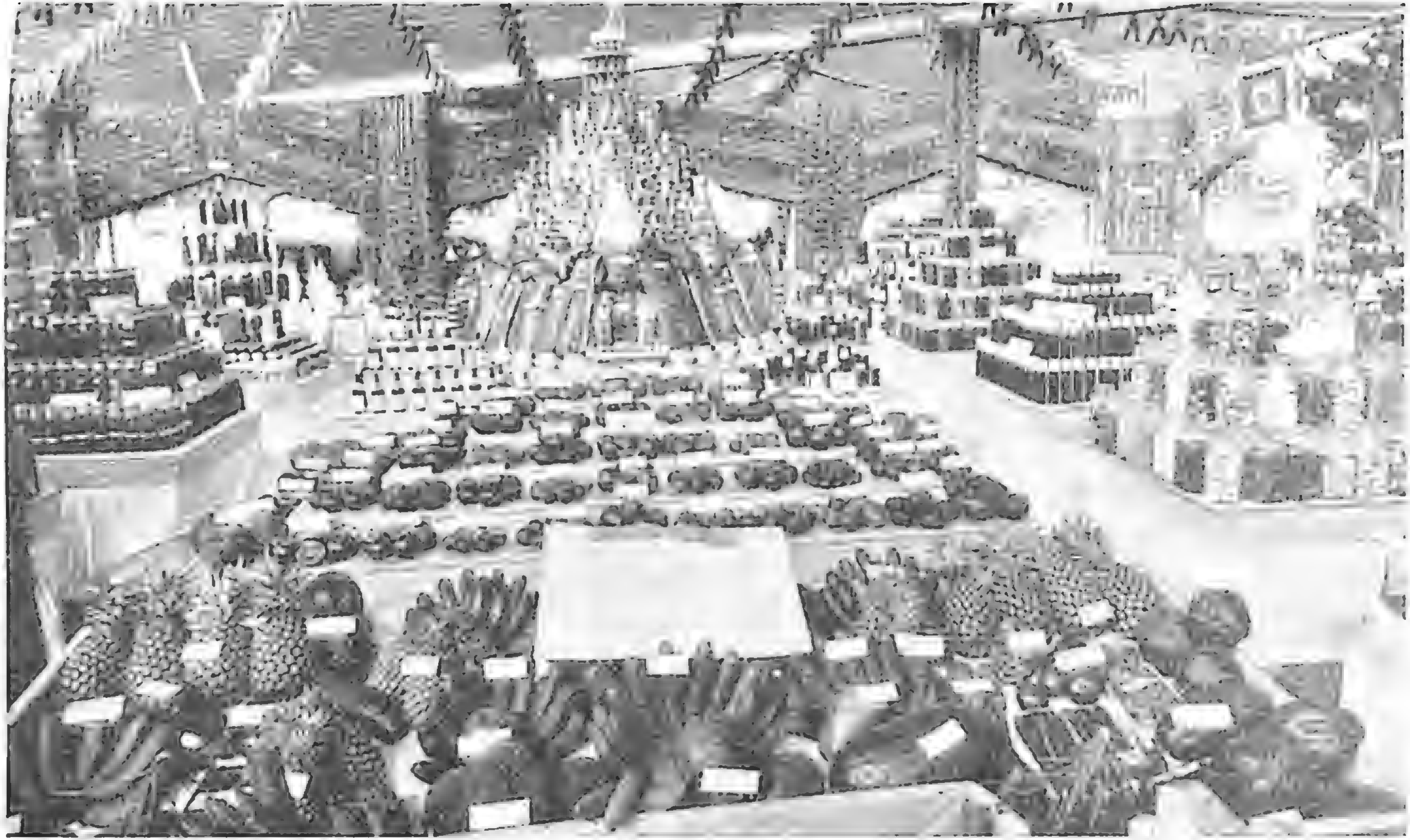


PLATE 181.—THE WEALTH OF WEST MORETON.

The winning display in the "B" Grade District Competition at the Brisbane Show. This remarkable exhibition of the products of field, mine, and factory from one of the richest provinces in Queensland, and of which only a portion came within camera focus, was one of the most popular pavillion features.

Marketing Oranges at Home and Abroad.

By JAS. H. GREGORY, Instructor in Fruit Packing.

(*Continued from page 132, Vol. XLII., Part 1—July.*)

PART III.

PACKING THE EXPORT CITRUS CASE.

THE Export Citrus Case (24 inches long by 11½ inches wide by 11½ inches deep clear of partition) is made up with a partition, there being two compartments, each with internal dimensions 12 inches by 11½ inches by 11½ inches. The following packing table is used, the packs being given for one compartment only, the total representing the quantity in the completed two compartments:—

Approx. Size.	Pack.	Layer Count.	No. of Layers.	Total.
2½	3—3	4 x 4	6	288
	3—3	4 x 3	6	252
2¾	3—3	3 x 3	6	216
	3—2	4 x 4	5	200
3	3—2	4 x 3	5	176
	3—2	3 x 3	5	150
3¼	3—2	3 x 2	5	126
	2—2	4 x 3	4	112
	2—2	3 x 3	4	96
	2—2	3 x 2	4	80

Care should be taken to pack each compartment with the fruit at the ends of the case almost level with the top of the end, whilst the fruit is up to 2 inches in height in the centre at the partition. This gives a natural bulge for the lid of about 1½ inches in the centre when nailed. A cardboard guard for the fruit is placed over the partition to assist in keeping the fruit from being damaged by the rough edges of the partition board.

Width of Boards in Made-up Case.—The boards of the sides, tops, and bottoms should not be more than half an inch apart when nailed on. Enough space should be allowed to permit free ventilation of the cold air through the case. The following is the size of timber necessary to make up the case:—

Ends and Centre Piece—Three pieces 11½ inches wide by 11½ inches deep by ¾ inch thick.

Sides and Bottoms—Six pieces 26¼ inches long by 5¼ inches wide by $\frac{5}{16}$ inch thick.

Lids—Two pieces 26¾ inches long by 5¼ inches wide by $\frac{3}{16}$ inch thick. The lid is made longer than the sides to permit the bulge.

Cleats—Two pieces 11½ inches long by ¾ inch wide by $\frac{3}{16}$ inch. thick.

Packers observing the following rules should have no difficulty in obtaining good results with their packing.

1. To ensure protection from stalk marks when packing, all fruit should be placed on the cheeks, facing end to end in the case, so that the stalks are then resting in the pockets.

2. Reverse the last line of oranges in each layer.

3. See that all fruit appears in straight lines from end to end in the case, across and diagonally.

4. No two oranges must rest directly one upon the other, but in the pockets of the layer beneath.

5. The size of the pockets governs the height of fruit in the case.

6. Do not use, unless absolutely necessary, any of the intermediate counts in Tables "B" and "D."

7. Reject all blemished or damaged fruit—"If in doubt, throw it out" is a good maxim. Make a second grade for blemished fruit.

In conjunction with the rules for packing, growers should observe the following rules whilst handling:—

1. Use gloves for all operations when packing for export. One glove only need be used, being on the hand handling the fruit.

2. Clip all fruit with the special commercial type of blunt-nosed citrus clipper, and on no account pull fruit from the trees. Don't use unsuitable clippers, such as scissors.

3. Where necessary make a second cut to remove any surplus stalk left on the fruit after removal from the tree. It is preferable to make two cuts and do the work properly.

4. Do not harvest fruit in damp, humid weather.

5. Transfer by hand fruit from one container to another whilst picking, sizing, &c.; do not roll or tip fruit.

6. See that all handling receptacles and machinery have no projections, screws, or splinters, of any kind that would be likely to injure the fruit.

7. Sweat all fruit before packing; this will ensure tight packs on arrival at the market.

8. Do not leave old, decaying fruit lying about the packing house or in cases, &c., used in the handling of the fruit.

9. Spray the sizing machine daily with a 1 in 20 solution of formalin; sheds, particularly floors, should be cleaned and sprayed regularly once a month; if export packing for overseas markets, the sheds should be sprayed weekly.

10. Do not sit or stand on cases of fruit when carting or handling, drive fast over rough roads, or stack carelessly on carts, trucks, &c.

11. Do not pack dirty fruit or fruit picked from the limbs near the ground.

12. For preference do not use picking bags. A proper picking bucket is better for careful handling.

13. Do not pack sour, immature fruit; it will only spoil the sales of the following consignments.

14. Take care to place battens under the case ends when nailing down cases.

15. When packing for overseas markets do not send too large or too small oranges away; counts 126 to 216 give a good range of sizes.

General Notes.

Sweating.—Before packing for export, oranges should be thoroughly sweated or cured by being harvested and stored in a cool place for five to ten days, according to the state of the weather, temperature, and ripeness of the fruit. This is necessary to overcome the shrinkage that is often experienced when fresh fruit is packed and sent to local market and remains unsold for a few days. Whilst the sweating of fruit is not absolutely necessary when growers are near their local market, nothing is lost if the fruit is held for two days before packing, the longer period up to ten days being necessary when sending long distances. Sweating is often of assistance also in eliminating fruit fly and otherwise damaged fruit.

Wiring.—It is recommended that all cases of first-grade fruit be wired. Care should be taken to wire the cases correctly. The wire should be placed around the case about a quarter of an inch inside from the inside edge of the case end. It is essential that wires be not placed around the middle of the case where the fruit will be squeezed when tension is placed on the wire. A machine is obtainable commercially which carries out this operation quickly and efficiently. Many country-order buyers pay a little extra and give preference to purchasing wired cases, as it saves them time and money when they can secure cases ready wired for long-distance transport. It can be seen from this that wiring can be a help in giving a sales preference to a grower's fruit on a slow market.

Case "Get-up."

Labels.—Having taken care in packing, growers should complete a good job by giving careful attention to the outside appearance of the finished case. A well-chosen fancy label is an attraction and an asset, being a cheap advertising medium, the average coloured label costing very little. Growers not marketing fruit in sufficient quantity to warrant an outlay on labels may still make their cases look attractive by neat stencilling. Where growers as individuals are not in the position to obtain labels, an economical means of obtaining the use of a label is for a number to join together and obtain a designed label with a common district brand design, only the grower's name and address (which could be added by rubber stamp) differing on each grower's label. This enables a quantity of labels to be procured, thus cheapening the cost. A label must have the grower's or packer's (i.e., packing house) name or brand and address, the address to include the word "Australia" in ½ inch letters. Spaces should also be left to include the variety, number or size of fruit, and grade standard; rubber stamps can be procured to insert these particulars after packing. It is recommended to brand on the label the count in preference to the size.

Good flour paste is satisfactory for applying labels. The paste is applied to half a dozen case ends at a time. The labels, which are soaked in a can of water, are drained and given an application of paste on their backs, placed on the pasted ends, and gently rubbed with a damp rag. A satisfactory paste is made from flour as follows:—Take 1 lb. flour, ½ oz. alum, and 1 pint water. Mix into a thick paste and then add boiling water until the paste thickens, stirring all the time. If too much boiling water is added, making the paste too thin, boil slowly, adding a little more flour. If to be used immediately the paste can be made without the alum or by adding a small quantity of bluestone as a preservative can be kept for short periods.

Stencilling.—If using stencils only and marketing in Queensland, under the Fruit and Vegetables Act it is necessary for the packer to brand his initials, name and address, legibly and durably within a space measuring not less than 5 inches long by 2 inches wide. The name of the variety of fruit and the size or count must also be branded in letters of not less than half an inch in height. When sending overseas the word "Australia" must be included in the address.

Branding.—Cases should be branded so that as little confusion as possible is caused to loaders and checkers during transit. A good system is to brand as follows:—

One End—Shipping or Agent's Number.

Examples:

409 LONDON	W.A. 12 BRIS.
(Export)	(Local)

Other End—Grower's name and address, Variety, Number, and Grade.

Example:

J. JONES,
Palmwoods,
Queensland,
AUSTRALIA.
SPECIAL
W. NAVELS 126

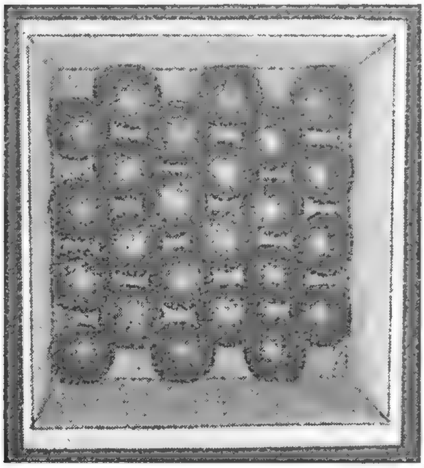
(Export or Local Market)

Good branding should be neat and should not show stencil ink smudges from running the brush over the edges of the stencil plate; make your stencils with a good margin around the lettering.

As the whole basis of successful marketing is care, growers should follow this principle right to the finish of their share of handling. Remember! Good packing, fancy labels, wiring, or stencilling will not sell bad fruit! All the care taken in putting up a first-grade, attractive package will be of no avail if growers, while carting the fruit to the station and loading into the trucks, do not handle it carefully. Too often we see carters sitting in the middle of packed cases of fruit while on the road, or walking all over packed cases whilst loading into railway trucks. Even good packing will not stand abuse, and so, in closing, every grower, carter, &c., is urged to handle the fruit from the tree to the consumer in the same manner as he would handle any delicate thing entrusted to his care. This should then enable us to get that return for which we strive for twelve months in and out of the orchard.

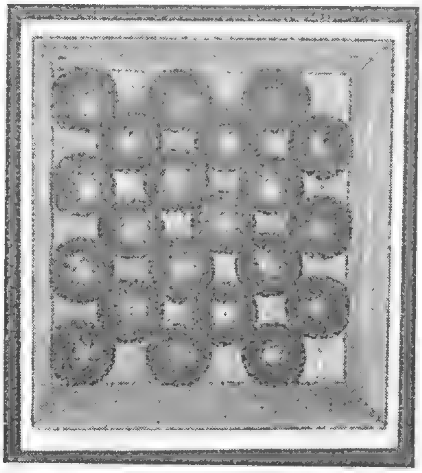
CITRUS EXPORT CASE.

First Layer.
3-3 Pack, 4 x 4 Layer Count.
6 Layers = 288.



Total, 288.

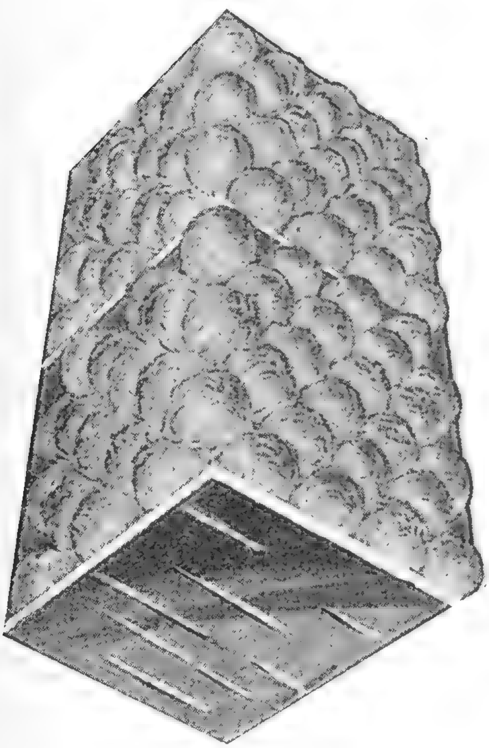
First Layer.
3-3 Pack, 4 x 3 Layer Count.
6 Layers = 252.



Total, 252.

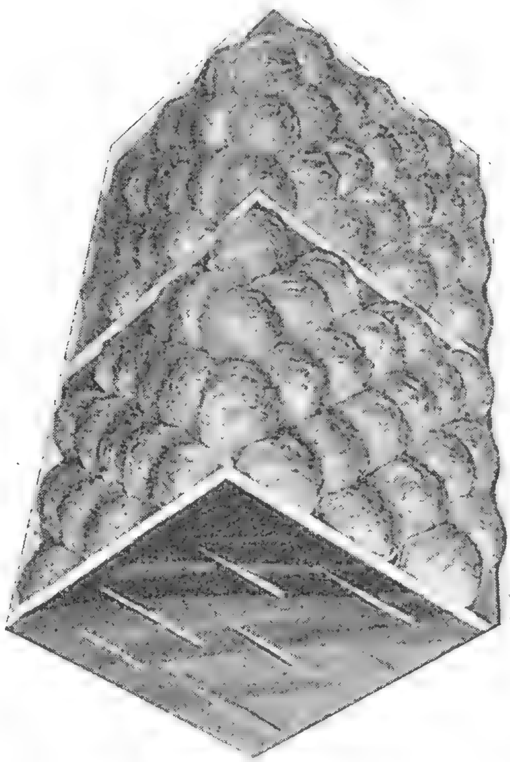
NOTE.—These first layers only represent a single compartment of the case. Each complete case contains two compartments which must be packed uniformly to obtain the correct count.

Finished Case.
Side. Top.



3-3 Pack, 288 Count.

Finished Case.
Side. Top.

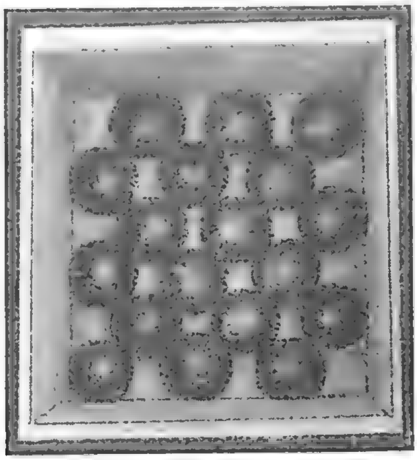


3-3 Pack, 252 Count.

PLATE 182.

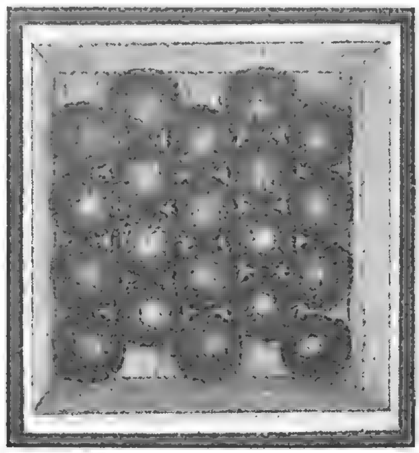
CITRUS EXPORT CASE—*continued.*

First Layer.
3-3 Pack, 3 x 3 Layer Count.
6 Layers = 216.



Total, 216.

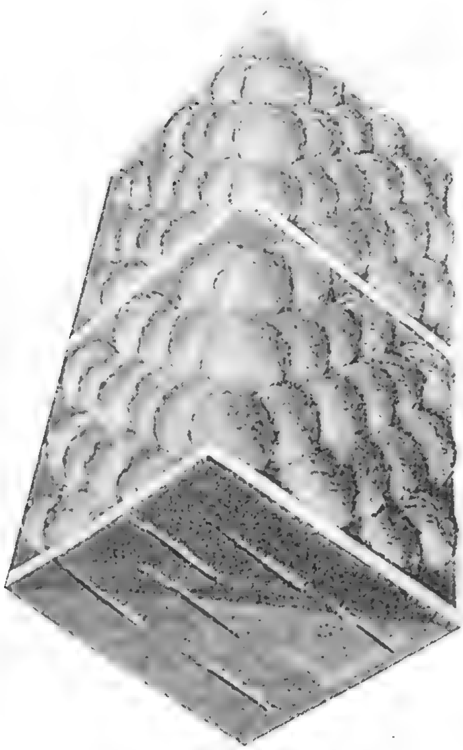
First Layer.
3-2 Pack, 4 x 4 Layer Count.
5 Layers = 200.



Total, 200.

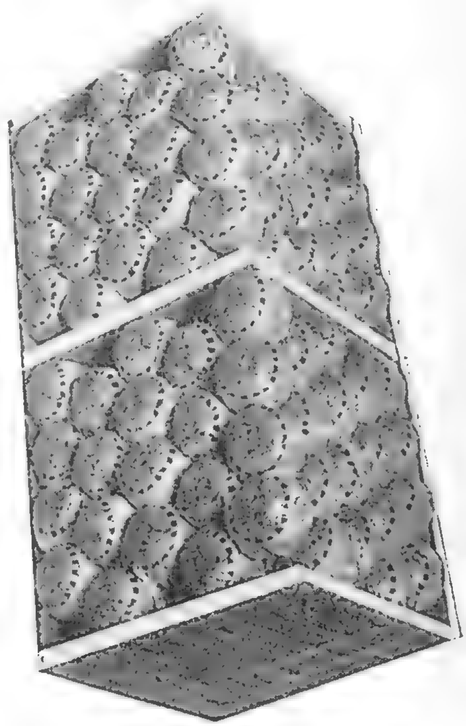
NOTE.—These first layers only represent a single compartment of the case. Each complete case contains two compartments which must be packed uniformly to obtain the correct count.

Finished Case.
Side. Top.



3-3 Pack, 216 Count.

Finished Case.
Top. Side.



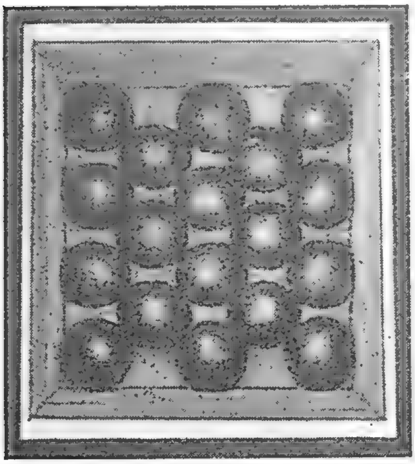
3-2 Pack, 200 Count.

NOTE.—This fruit is wrapped with the Australian Export Kangaroo Wrapping Paper.

PLATE 183.

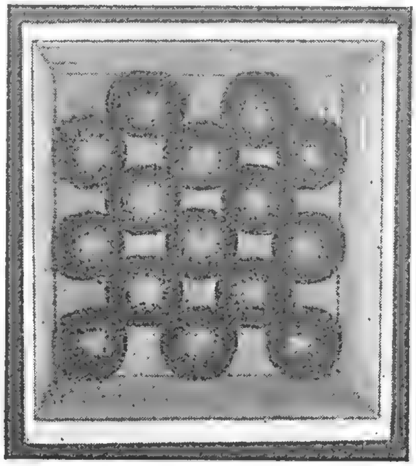
CITRUS EXPORT CASE—*continued.*

3-2 Pack, 4 x 3 Layer Count.
5 Layers = 176.



Total, 176.

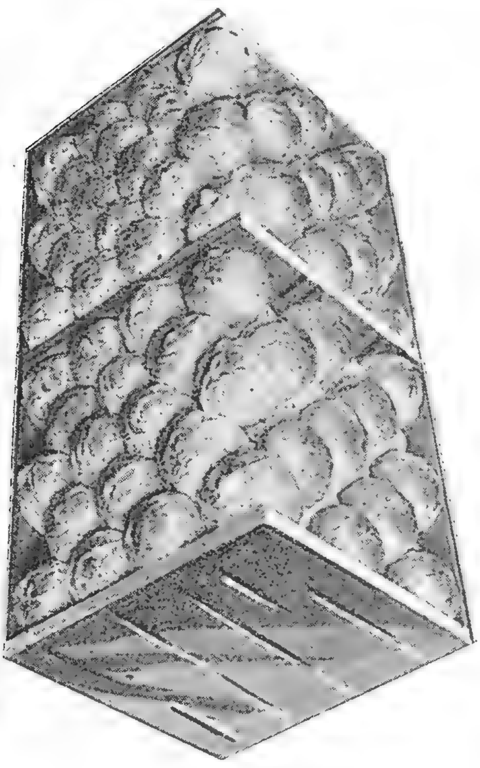
3-2 Pack, 3 x 3 Layer Count.
5 Layers = 150.



Total, 150.

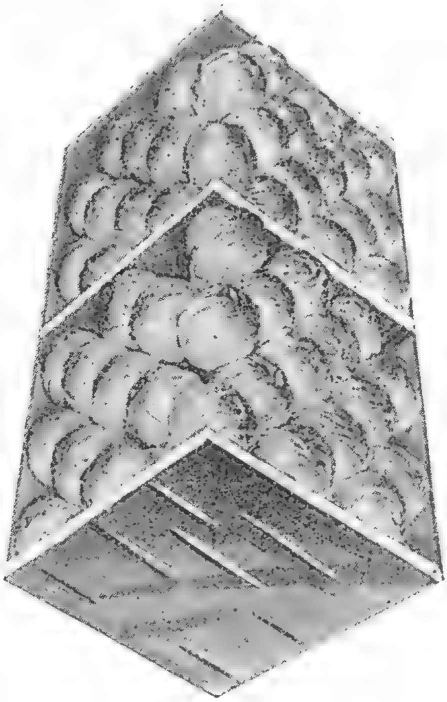
NOTE.—These first layers only represent a single compartment of the case. Each complete case contains two compartments which must be packed uniformly to obtain the correct count.

Top. Side.



3-2 Pack. Total, 176.

Side. Top.

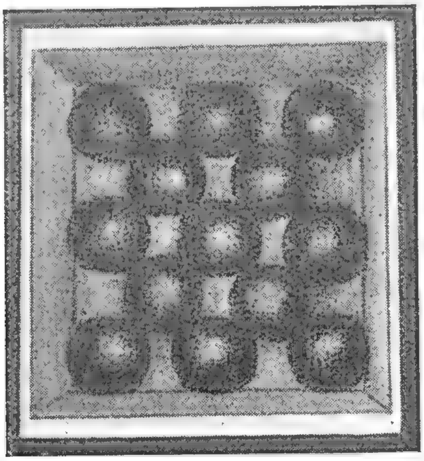


3-2 Pack. Total, 150.

PLATE 184.

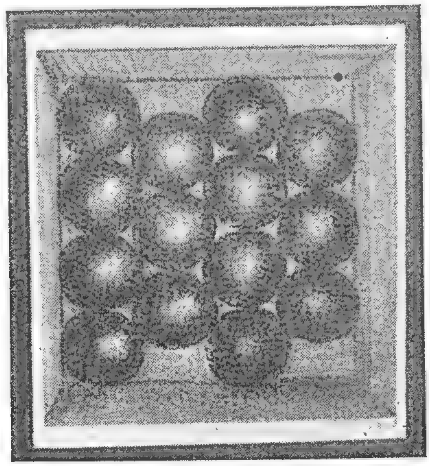
CITRUS EXPORT CASE—*continued.*

First Layer.
3-2 Pack, 3 x 2 Layer Count.
5 Layers = 126.



Total, 126.

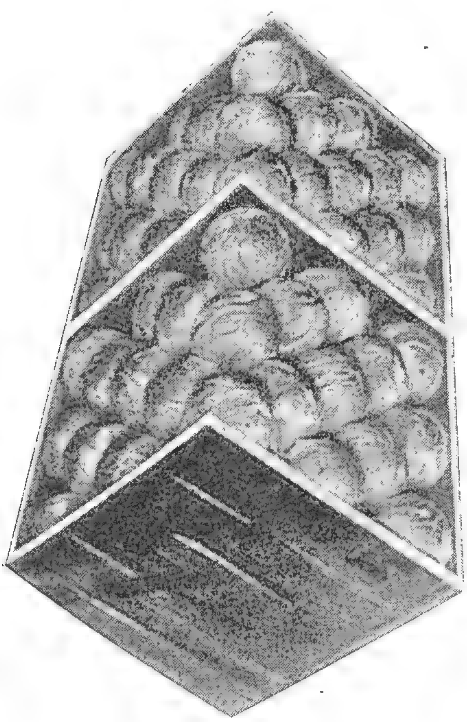
First Layer.
2-2 Pack, 4 x 3 Layer Count.
4 Layers = 112.



Total, 112.

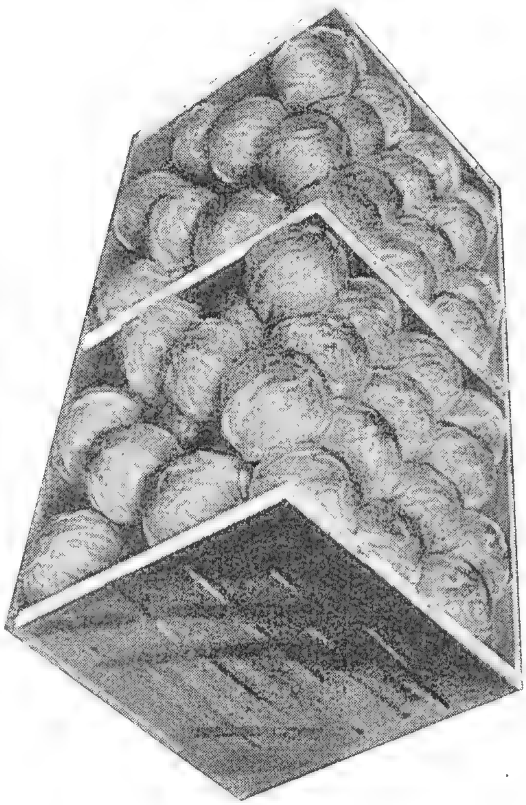
NOTE.—These first layers only represent a single compartment of the case. Each complete case contains two compartments which must be packed uniformly to obtain the correct count.

Finished Case.
Side. Top.



3-2 Pack. Total, 126.

Finished Case.
Side. Top.



2-2 Pack. Total, 112.

PLATE 185.

The Cowpea.

By N. A. R. POLLOCK, H.D.A., Senior Instructor in Agriculture.

THE genus Vigna of the natural order Leguminosæ, to which the species cultivated and known as cowpeas—though they are really beans—belong, comprises upwards of thirty examples which are widely distributed over the warmer regions of the globe.[1] Bailey[2] records four as Australian species, three of which have a wide range in other parts, while one is endemic.

The cultivated varieties of the cowpea are held to be derived from *Vigna sinensis,* a native of Central Africa, where, according to Piper,[3] wild plants little differing from those cultivated are still to be found.

The large number and diversity of cultivated varieties throughout Africa and the warmer parts of Asia and Europe suggest that the crop was cultivated for many centuries.

It is probable that the cowpea was included in the varieties of beans mentioned under the name Phaseolus by old Roman writers, since in Italy the name Fagiolo, the local equivalent of Phaseolus is applied equally to the Kidney bean and the Blackeyed cowpea.[4]

PLATE 186.—A COWPEA CROP ON A NORTH QUEENSLAND FARM.

In countries where the Spanish language is used, the cowpea is referred to as Frijole or Figole, which may also be considered a derivative of Phaseolus.

There are three main varieties of the Cowpea, viz.:—

Vigna sinensis var. *sesquipedalis.*

The Snake, Yardlong or Long Bean, also Asparagus Bean. This subspecies comprises a number of varieties, noted for their long, soft,

and puffy pods, which carry an elongated kidney-shaped seed. They are usually grown on sticks or poles, also without support, and the young pods used when green and brittle in the manner of French beans.

In tropical parts they are much favoured in the summer for culinary purposes. The pods of many of the cowpeas proper, however, are not only more palatable but capable of more economic production.

Vigna sinsensis var. *Cylindrica*.

The Catiang or Indian cowpea, as it is frequently called. This subspecies forms a group of varieties of semi-erect, half bushy plants with pods 4 or 5 inches long, carrying small, hard seeds usually oblong or cylindrical and slightly kidney-shaped. They are generally late in maturing, and on this account not generally popular. The Poona (see under varieties), however, is an exception.

Vigna sinensis.

The common cowpea, of which there are a great many varieties, and to which the balance of the subject matter of this article refers.

Climate.

The cowpea is essentially a summer crop, as it is easily killed by frost. Being a native of warm climates, it can be expected to make the best success in the more tropical parts of the State; but if sown as soon as danger from frost is over, good crops should be obtained in the cooler parts or where a crop of maize can be produced.

It will stand a moderate amount of dry weather, under which condition yield of forage and seed will be much reduced.

Under a heavy rainfall, while the volume of growth will be satisfactory, the yield of seed will be small. The bottom leaves also will be liable to mildew, owing to a poor circulation of air through the mass. Heavy or continuous rain when the pods are ripening is also apt to cause mildew in the seeds.

The best success can be anticipated when growth is made in the hottest months under a good rainfall and fine weather is experienced at harvest or when the pods mature.

Soil.

The cowpea will succeed on almost all types of soil that are sufficiently drained or do not become water-logged. Good crops can be anticipated when growth is made on sandy soils and intermediate types to heavy clays, provided a reasonable amount of plant food is present, the season is favourable, and satisfactory cultivation practised.

The necessity for lime in the soil, so general with most legumes, is less insistent in the case of the cowpea than with others.

On rich soils, a heavy growth of vine may be expected when the yield of seed will be comparatively low. Soils of medium fertility may be expected to yield the largest crops of seed.

Generally speaking, what is regarded as good maize land can be expected to produce the best crops of cowpea both in yield of vine and seed.

Cultivation and Sowing.

The soil should be well ploughed to a depth of at least 6 inches, cross-ploughed if necessary, and brought to a good tilth.

Sowings are usual of single seeds, 3 or 4 inches apart in drills spaced 3 feet apart.

Sown in this manner, 6 to 10 lb. of seed, according to its size, which varies with varieties, will be sufficient for an acre.

An ordinary corn-planter with a suitable plate is satisfactory for sowing, as is also a grain drill when sufficient of the cups are closed to allow of the required spacing.

In broadcast sowing, 20 to 30 lb. is sufficient on clean ground, but frequently larger quantities are used.

PLATE 187.—A CLOSER VIEW OF A COWPEA CROP.

When sown in this manner, it is advised to have the land somewhat rough and to fine it down with the harrows when covering the seed.

Cowpea seed germinates very quickly, the young plants frequently showing on the third day after sowing.

After cultivation consists in keeping weed growth down and the soil loose between the rows of plants while growth permits, usually over a period of four to five weeks if the season is favourable.

The ordinary cultivators, such as are used with maize, are satisfactory.

Harvesting—Hay.

The best time to cut the crop for hay is when flowering has progressed a little time and a fair quantity of pods have formed. Sometimes, in order to secure seed as well, the crop is left until most of the

pods have matured; the seed is then threshed out or secured from the sieves when cut into chaff. In the latter case the vines are more fibrous, and less leafage can be expected.

In making the hay, the growth should be placed in small, loose cocks as soon as possible after signs of wilting have appeared, so that the circulating air will assist in the transpiration of moisture from the vines through their leaves. After a day usually in the small cocks, two or more can be used to form a larger one until curing is complete. As the leaves afford the greatest nutriment, their retention should be the main objective.

Seed.

When ripe, the pods will assume a straw colour. At this stage rainy or extra humid conditions will cause the seed to mould or to sprout within the pod. The value of fine weather at this stage is therefore apparent.

Frequently, as the pods ripen progressively, especially with late-maturing kinds, it is found profitable to hand-pick the first setting and to secure the remainder by harvesting the plant. Early-maturing kinds usually ripen the majority of the pods within a short space of time, which allows the plants to be harvested and the seed secured by threshing, or from the sieves by cutting into chaff. When securing the seed in this manner it is of advantage to have the vines thoroughly dry and brittle.

When the pods are hand-picked they should be thorough dried, when they are easily broken and the seed secured. The proportion of seed is usually 70 per cent. of the whole pods.

Yields.

The yields of forage or seed of any variety will depend on the fertility of the soil and the season experienced.

Late-maturing varieties, owing to a longer growing period, can be expected to give much heavier yields than those of earlier habit.

From 3 to 4 tons up to 10 to 15 tons of greenstuff and from 3 to 4 up to 20 to 25 bushels of seed may be anticipated under reasonable conditions of soil and season.

Departmental trials in North Queensland over a series of years gave the following results:—

Variety.	Average Yield per Acre.	Number of Trials.	Highest Yield.
	Tons Cwt. Qr.		Tons Cwt. Qr.
Groit	12 0 0	15	22 10 0
Brabham	12 10 0	6	18 19 1
Victor	11 3 0	4	19 5 2
Black	6 5 0	2	6 6 0
Clay	6 0 0	1	

The highest yield of these were recorded as follows:—

Groit Variety.—Carbeen, sown 28th November, estimated 10th February; yield, 16 tons 11 cwt. in 74 days; after further growth estimated 17th April, yield, 22 tons 10 cwt. in 140 days.

Victor Variety.—Tolga, sown 23rd January, estimated 1st May; yield, 19 tons 5 cwt. 2 qr. in 97 days.

Brabham Variety.—Tolga, sown 23rd January, estimated 1st May; yield, 18 tons 19 cwt. 1 qr. in 97 days.

Uses.

Green Manure.—The use of the cowpea as a green manure is becoming increasingly popular, largely from the fact that it provides a big volume of growth in a comparatively short time. In common with most other legumes it adds, in addition to the organic matter, an appreciable quantity of nitrogen to the soil; this is demonstrated by the multitude of nodules formed on the roots by the nitrogen-fixing bacteria.

The greatest volume of growth is naturally afforded by the late-maturing varieties, suggesting these should be sown early in the season.

Quick-maturing sorts are valuable to follow a crop harvested in early summer.

Rotation.—The value of a legume in a sequence or rotation of crops is generally appreciated, not only when it is ploughed under to augment the supply of organic matter in the soil, but from the more vigorous growth of a succeeding crop caused by the added nitrogen from the decay of the roots after the top growth has been removed. Crops such as maize, potatoes, &c., following a cowpea crop, whether cut and removed or ploughed under, invariably experience benefit.

Culinary Use.—The green pods of many of the varieties when young and brittle are esteemed as a table vegetable. Use in this manner is particularly suggested in the summer of tropical parts when other beans, similarly used, cannot be grown.

The seed of many kinds, particularly those white or mottled white in colour, are also esteemed when mature and dry as a haricot bean.

Fodder.—Being a legume and consequently rich in protein, the fodder value of the cowpea at all stages of growth, whether fed green or cured as hay, is exceedingly good.

Combined with its high fodder value is extreme palatability, all stock eating it readily.

Henry and Morrison[5] present the following analyses:—

——	Total Dry Matter in 100 lb.	Digestible Nutrients in 100 Lb.				Nutritive Ratio. 1 :
		Crude Protein.	Carbo-hydrates.	Fat.	Total.	
Seed	88·4	19·4	54·5	1·1	76·4	2·9
Hay before Bloom	92·2	17·8	27·0	1·0	47·0	1·6
Hay in Bloom to Early Pod ..	89·4	12·6	34·6	1·3	50·1	3·0
Hay Ripe Vines	90·0	6·9	42·1	1·0	51·2	6·4
Hay—All Analyses	90·3	13·1	33·7	1·0	49·0	2·7
Green Vines	16·3	2·3	8·0	0·3	11·0	3·8

The seed, it will be observed, according to the analysis, provides a valuable protein concentrate for feeding to all kinds of stock, including

poultry, though the latter do not often take readily to the whole seed. As the seeds of all varieties are relatively small, they should be crushed or ground to a meal before being fed to stock, and in this state added to the mash for poultry.

Grazing Off.—As a crop for grazing off at all stages of growth, the cowpea offers many advantages. Dairy cows and growing and fattening stock can be grazed for periods each day until growth has ceased, when that not consumed can be ploughed under with ultimate profit. Pigs can also be profitably raised when depastured thereon.

Hay.—When cured as hay a valuable roughage is provided, which can be fed whole or chaffed with other feeds to secure a desired nutritive ratio.

Silage.—The cowpea can also be successfully ensiled when combined with other crops such as maize or sorghum. Added to either of the latter an advantage is gained by the consequent increase of protein.

Plate 188.—As a Cover Crop, the Cowpea is an Important Factor in Farm Economy.

Cover Crop.—The cowpea has found favour as a cover crop with banana-growers and orchardists to keep down weed growth and to add fertility to the soil. Varieties of upright growth or those of short-running habit, such as the "large clay coloured," are favoured.

As a crop to precede the sowing of lucerne, the cowpea can be recommended, as not only is the land kept free of weed growth and a clean seed-bed provided, but it is inoculated with a nitrogen-fixing bacteria which appears to favour lucerne.

Mixed Crops.

The cowpea can be grown with advantage when the seed is sown mixed with that of other crops, either for grazing off, for silage, or for hay.

With Maize.—Where growth of maize is not too rapid as in the cooler parts of the State, the seed of early sorts can be sown immediately, after the last cultivation of the maize, in the centre between each row. In the warmer parts it is advised to sow both seeds at the same time in the same row, using later-maturing varieties of cowpeas.

The resultant crop can be cut for silage or grazed, or the maize grain can be harvested and the stock then turned in. The mixed crop is considered valuable for raising and fattening pigs.

With Sudan Grass, &c.—Sown combined with Sudan grass, various millets or sorghum broadcast, the addition of the cowpea will improve the fodder value, either when fed off or cured as hay. Both seeds should be sown at the same time. It is advisable, when sowing cowpeas in a mixture, to use those of less erect and more running habit of growth.

Varieties.

Varieties of the cowpea differ in their manner of growth as well as in the period in which they ripen the first pods. Some are early maturing, others late; some are inclined to erect or bushy growth with short runners, while others are procumbent with long runners. Intermediate forms between the two, of course, occur. Some varieties are valuable for their heavy yield of forage, others for the amount of seed they yield.

New Era.—Plants tall, half-bushy, and of vigorous growth. Yields seed freely. Matures medium early, the first pods ripening in about 70 days. Seeds rather small, buff coloured, and speckled with blue.

Whippoorwill.—Plants tall, sub-erect, and half-bushy, giving an abundant growth—a good general purpose kind—matures the first pod in about 80 days. Seed buff coloured, marbled with brown. Pods tend to cluster, which facilitates hand-picking.

Groit.—Regarded as a cross between New Era and Whippoorwill[4] and considered superior to both. It is much favoured in North Queensland. The plants are sub-erect, half-bushy, and of prolific growth. The first pods ripen in about 75 days. Seeds somewhat small and angular, buff in colour, marbled with brown, and thickly sprinkled with bluish spots.

Brabham.—Regarded as a cross between Iron and Whippoorwill varieties.[4] It has done well in the North. The plants are fairly tall, half-bushey, and very prolific. The first pods ripen in about 85 days. Seeds buff in colour, marbled with brown. This variety is regarded as resistant to nematode attack.

Iron.—Plants tall, half-bushy, of moderate growth, and not a free seeder. It is extremely hardy and late in maturing, the first pods ripening after about 90 days. Seed pale-yellowish to reddish-buff. This variety is regarded as resistant to nematode attack.

Victor.—An artificial cross between the Brabham and Groit varieties, originated by the United States Department of Agriculture.[4] Plants tall, half-bushy, and very prolific. The first pods mature in from 80 to 85 days. Seed small brownish-buff and covered with small blue specks. Said to resist nematode attack. It has done well in the North.

Early Clay.—Plants sub-erect and bushy—fairly prolific. An early variety, the first pods maturing under 60 days. Seeds light-buff with a suggestion of pink. The variety, being one of the earliest, is most suitable for the colder districts of the south.

Early Black.—Plants rather procumbent and viney, but yield abundantly. The first pods mature in about 60 days. Seeds black. The variety is suitable for growth with maize or other crops for conservation as fodder or for grazing off. There are a number of varieties with a black seed which vary somewhat in habit of growth and the period of maturity.

Blackeye—Mottled White—Cream and White.—These varieties are regarded as inferior for fodder purposes, and are usually grown for the seed, which is esteemed for table use.

Fertilizers.

Where the soil gives an acid reaction, a top-dressing of lime at the rate of 10 cwt. per acre, or carbonate of lime (earthy lime) at the rate of 20 cwt. per acre, should be applied broadcast to the soil prior to sowing the seed. Though lime is not called for so insistently as in the case of lucerne, its application will be attended with profit on many soils, more especially those in districts of heavy rainfall. Poor soils, such as those of very sandy nature on which the production of bright tobacco is advised and soils somewhat exhausted by continuous cropping, will be benefited by the application of fertilizer. On the more fertile the inclusion of nitrogenous fertilizers is not imperative, as on these soils little benefit is received therefrom, but on those of poorer quality it will be most beneficial. The following mixtures are suggested for each 100 lb.:—

For poor soils—Sulphate of ammonia, 10 lb.; superphosphate, 75 lb.; sulphate of potash, 15 lb.

For better soils in which the humus content is fair—Superphosphate, 85 lb.; sulphate of potash, 15 lb.

Applications may be made at from 100 lb. to 300 lb. per acre, preferably in the drill at the time the seed is sown.

Diseases.

So far in Queensland little trouble has been experienced from disease in cowpea crops beyond slight leaf-spots and the moulds formed on leaves and seed under heavy or prolonged falls of rain.

In other countries trouble has been experienced from wilt caused by a fungus which invades the roots, and, by impeding the flow of sap, causes a wilting and subsequent drying off of the top growth.

Nematodes.

Several varieties are subject to attack from eelworms or nematodes, which form gall-like swellings on the roots and interfere with the growth of the plant. These swellings differ from those formed by the nitrogen-fixing bacteria, which are small, about a quarter of an inch in diameter, and easily detached. Those formed by nematodes are frequently large and massed together, and cannot be detached without breaking the roots. Where nematodes occur—most frequently on sandy soils—the use of resistant varieties is called for.

Insect Pests.

At times the French Bean Fly—*Agromyza phaseoli*—attacks the cowpea in early growth, but damage therefrom, has, so far, not been serious.

The chief insect enemy is a bean weevil which lays its eggs in the pod of the cowpea in the field and also in the stored seed.

While prevention is not possible in the field, the attack of the insect after harvest may be frustrated by treating the seeding in the following manner:—

Exposure to a heat of 120 deg. to 130 deg. Fahr. for an hour or so will kill all insects as well as their eggs. In the warmer parts this heat can frequently be obtained from the sun if the seed is thinly spread on tarpaulins or sheets of iron. Artificial heating by means of hot flues can also be effected.

Fumigation with carbon bisulphide for twenty-four hours.—For treatment the seed should be placed in an air-tight container. In using the carbon bisulphide, 1 lb. is suggested for each 100 bushels of seed, and should be placed in saucers or shallow pans on top of the grain. As it volatilizes, the gas being heavier than air will sink through the grain. After twenty-four hours' contact the grain should be well aired to become free of the gas, which, if left longer, would interfere with germination, and then replaced in air-tight containers. Carbon bisulphide being highly inflammable, care in its use is imperative, no fire or flame being allowed nearby. At temperatures in excess of 60 deg. Fahr., it is most effective.

All stored seed should be thoroughly dry.

REFERENCES.

[1] Encyclopedia of Horticulture. Nicholson.

[2] The Queensland Flora. F. Manson Bailey.

[3] Piper, C. V. The wild prototype of the Cowpea. Circ. 124. United States Department of Agriculture.

[4] Morse, W. J. Farmers' Bulletin 1148. United States Department of Agriculture.

[5] Feeds and Feeding. Henry and Morrison.

TO SUBSCRIBERS—IMPORTANT.

Several subscriptions have been received recently under cover of unsigned letters. Obviously, in the circumstances, it is impossible to send the Journal to the subscribers concerned.

It is most important that every subscriber's name and address should be written plainly, preferably in block letters, in order to avoid mistakes in addresses and delay in despatch.

Dairy Produce Act Provisions Explained.

STABILISING THE INDUSTRY.

THE Dairy Produce Act, which was passed by the Commonwealth Parliament towards the close of last year, provides for the regulation of the transfer of butter and cheese from one State to another, and is on similar lines to the Dried Fruits Act, which was passed by the Commonwealth Parliament in 1928. Its main object is to ensure to all producers of butter and cheese a fair share—and not more than a fair share—of the advantages and disadvantages of selling within Australia and overseas, says an official statement issued at Canberra to-day.

Five years ago Australia exported 45,000 tons of butter overseas. During the year ended 30th June, 1934, this total had more than doubled and reached the high figure of nearly 109,000 tons, of which no less than 102,000 tons were sent to the United Kingdom. The value to Australia of this export trade last year was about £9,000,000.

Great Britain is the principal purchaser of our dairy products. Indeed, apart from a valuable market for some 6,000 tons in the East, the United Kingdom represents practically the only outlet for our exportable surplus, and year by year we have been sending greatly increased quantities to that market.

At the same time increasing quantities of New Zealand and Danish butters were being placed on the British market, and in these circumstances a fall in prices in the United Kingdom was inevitable, in order to bring about the necessary increase in consumption to absorb the greatly increased imports.

The Paterson Scheme.

Until recently a voluntary scheme was in operation known as the Paterson Plan, which was designed to assist in ensuring a more remunerative price for butter sold in Australia. Under this plan a levy was paid on all butter manufactured, and from the fund thus created a bounty was paid on all butter exported.

The existence of the bounty on exported butter brought about an automatic increase in the local price, and the dairying industry profited considerably from this enhanced price.

In view of its voluntary nature, it has been found difficult by the dairying industry to sustain the Paterson Plan. For some time there was an increasing tendency on the part of factories to break away from the scheme, and the industry claimed that another section of the butter-producing industry—the people who make butter on farms—were not making any contribution towards the stabilisation of the industry. These persons, together with the factories which had broken away from the plan, were reaping the full advantages and benefits of the improved conditions made possible by means of the Paterson Plan. In consequence of these circumstances and because of the large amount of butter being exported, the scheme rapidly lost its effectiveness.

The question of stabilising the industry by means of State and Federal legislation on the lines of the existing Dried Fruits legislation was first discussed at a Conference of Ministers for Agriculture held in

May, 1933, and in the following month the matter was further discussed at a conference of Premiers, at which the Commonwealth Government agreed that it would fully consider any proposal for the introduction of Commonwealth enabling legislation in the event of the adoption by the States of marketing measures in respect of butter.

The States of New South Wales, Victoria, Queensland, and Tasmania, which, in the aggregate, produce approximately 90 per cent. and 80 per cent. of the total output of butter and cheese respectively in Australia, have enacted legislation under which a Board has been established in each of those States to regulate the intra-State marketing of butter and cheese.

The Home Market.

One of the principal provisions in each of the State measures is that which empowers the respective State Ministers in conjunction with the proposed Boards to determine the quantities of butter and cheese which may be sold on the home market. The States, however, are not empowered to regulate the interstate transfer of goods without which it would not be possible to ensure that the balance of butter and cheese over and above that determined for home consumption shall be exported overseas. To meet this position, it was essential that there should be Commonwealth legislation which would prohibit interstate trade in butter and cheese except under license, which license will only be granted subject to the condition that the licensee shall comply with export quotas fixed by the Minister for Cmmerce. These export quotas are determined on the recommendation of prescribed authorities appointed by the Commonwealth. In those States where Boards are established under State legislation, the Boards act as Prescribed Authorities. The export quota determined in respect of butter manufactured during the months of May and June, 1934, was 55 per cent. and 50 per cent. for the month of July. The first export quota fixed for cheese was 25 per cent. for the month of July.

The system of export quotas prevents price-cutting on the Australian market, and assures that the producer will take his fair share of the less remunerative export markets—that is to say, the burden of export is equally shared.

Protection Against Gluts.

The system of control as is now applied to the dairying industry in relation to interstate trade does not necessarily involve any increase in the price to the Australian consumer over and above the additional cost previously brought about by the operation of the Paterson Plan. The Government believes it is necessary to the interests of the industry that those engaged in it should be protected by legislation against the possibility of glutted home markets and consequent adverse realisations.

The Federal Act was brought into operation by proclamation issued on the 2nd May, 1934, and it is provided in the Act that a poll of dairy producers throughout the Commonwealth shall be taken within six months after the commencement of the Act, to decide whether or not the legislation shall continue to operate. In this connection the Government considered that notwithstanding the assurances given by representatives of the industry to the effect that a majority of the producers were favourably disposed towards marketing legislation of this nature, it was desirable that the producers should be given the right to decide the matter for themselves.

The persons eligible to vote are those who, during the year ended 31st December, 1933, were producers of milk and either manufactured and sold at least 500 lb. of butter and/or cheese, or supplied to a factory sufficient milk or cream to produce at least 500 lb. of such produce. Where two or more partners produced the necessary quantity of milk or dairy produce from cows owned by them, each partner is eligible to claim enrolment, and in the case of farms worked on the share system the owner of the cows is regarded as the person entitled to claim enrolment. Each voter is entitled to one vote only, notwithstanding the number of farms in which he may have an interest.

The Closing Date.

The closing date for the poll is the 11th October, 1934.

There is in existence another organisation which is not controlled in any way by Commonwealth or State legislation. This organisation is known as the Commonwealth Dairy Produce Equalisation Committee Limited, which is registered under the New South Wales Companies Acts, with headquarters in Sydney.

The principal function of the committee is to secure to manufacturers of dairy produce, as far as reasonably practicable, equal rates of returns from sales made in Australia and overseas. In cases where manufacturers either over-sell or under-sell (on a quantity basis) on the Commonwealth market, an equalisation cash adjustment is made by the committee representing the difference between the Australian and overseas prices.

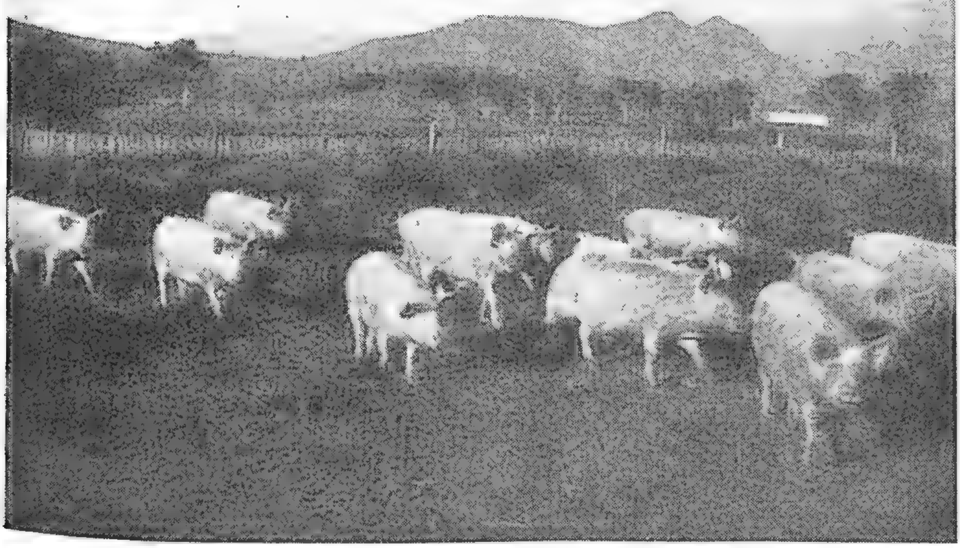


Plate 189.—Large White Grade Baconers at Mr. C. B. Peter Bell's Pig Farm, Maroon, near Boonah.

This is a typical scene on Maroon, where approximately 1,000 pigs are raised each year under grazing conditions and fed entirely on maize and meat meal with lucerne and paspalum pasture.

Pampas Grass as Winter Cow Feed.

EXTRACTS FROM AN ARTICLE BY MR. B. C. ASTON, CHIEF CHEMIST, DEPARTMENT OF AGRICULTURE, NEW ZEALAND, IN THE NEW ZEALAND JOURNAL OF AGRICULTURE FOR 21ST MAY, 1934.

The Government Botanist, Mr. C. T. White, who has extracted this article, states that the correct name of the Pampas Grass, according to determinations received from the Royal Botanic Gardens, Kew (England), is Cortaderia Selloana, *though it is most frequently known to gardeners under the older name of* Gynerium argenteum. *Mr. White further states that it is quite common in gardens in many parts of Queensland, and the article by Mr. Aston seems to offer a use for the grass hitherto undreamt of. It is a tall-growing grass familiar to most people on account of its white, feathery plumes. A rather smaller kind with reddish plumes is sometimes seen. This is not a different species or variety as sometimes thought, but represents the male plant, the white being the female. Propagation of the plant is by seeds or divisions. It is not certain that the plant provides fertile seed in Queensland, but the general means of propagation is by division of the plants, a large clump giving a great number of roots suitable for planting out.*

The best time for planting out the grass is probably about September and October, or during the early summer rains, and about 1,000 plants would be required to plant an acre, the plants or roots being placed about 6 feet apart each way.

It might be mentioned that the grass when tested for the presence of a prussic-acid yielding glucoside has always given positive results for the presence of such a glucoside in Queensland-grown specimens, but if reasonable care is exercised in not letting cattle on to the grass on too empty a stomach, or allowing them to gorge themselves on it, little or no trouble should be experienced from it.—ED.

Mr. Aston writes: When dead or old leaves are prevented from accumulating by firing every year after cattle have eaten down the succulent green portions and some of the dead leaves, the subsequent growth is tender and easily grazed by cows.

One farmer, Mr. George Short, of Dargaville, writes that twenty-two years ago he had his first experience of pampas, and since then he has always grown it for shelter and stock food, for in winter all stock are fond of it, breaking down good fences to get at it. He has grown it on drain banks, in paddocks, and on hill land. It grows as well on poor gum land as it does on good swamp land. It would be a great asset to exposed farms near the coast where other shelter cannot thrive owing to salt winds. Mr. Short has not grown it for fodder alone, but knows its value as stock food. He sends photos of hedges he planted at Turiwiri, Northern Wairoa, one of the oldest of which is six years old and 10 feet high and shows signs of being well grazed as far as cattle can reach.

To Mr. Alec McClean, of Waitakaruru, Hauraki Plains, must, however, be given the great credit of being the first to profit adequately from his observations that cattle are inordinately fond of pampas in the autumn by systematically planting and using it as winter feed as described in the previous article. Since then Mr. McClean has extended

his plantations and has continued to use pampas systematically as winter food and has answered all inquiries which have come from both local and overseas farmers. He has willingly received and explained to deputations of agriculturists, chemists, veterinarians, pressmen, and other farmers his method. He has also supplied, at a nominal price, roots to those desiring to make experiments. Success has not come to Mr. McClean without perseverance in the face of many obstacles. Without knowing any of the previous opinions or work of others with pampas, and without any official guidance and advice, and, as he puts it, in the face of all sorts of discouragement and carping criticism which required quite a lot of determination to disregard, he has demonstrated beyond doubt that a new fodder plant is available which is destined, it is thought, to have very far-reaching effects in cheapening production in every branch of cattle farming.

The result of pampas-feeding on Mr. McClean's own cattle has been the subject of investigation by competent visitors who have expressed their appreciation of the condition of the stock on the farm. Although milking what is called "a very ordinary herd," mostly Jerseys, he is topping his district against all suppliers for amount of butter-fat per cow per month, which is shown by the factory returns, although many of his neighbours have wellbred stock with high butter-fat records. Mr. McClean's results are all the more remarkable as no top-dressing is done on his farm. The soil is not excessively moist in Ngatea, and in summer months it becomes decidedly dry. The soil is peaty, the subsoil being a rich clay. For further information of the Hauraki Plains soil see this "Journal," June, 1914.

Mr. McClean's method of laying out his plantations is simple and efficient. An area 1 or 2 chains wide and several chains in length is planted in the spring with pampas roots 6 feet apart, which provides approximately 1,000 plants to the acre. These are not fed-off until the second year, by which time the estimated yield of green material per plant is, roughly, 1 cwt., or 50 tons to the acre.

During the past winter Mr. McClean has fed 130 head of grown stock and 70 head of young stock on 2 acres of pampas with a run-off of 48 acres. Feeding-off was commenced on the 14th June, 1933, and finished on the 20th August, a period, approximately, of ten weeks. The method by which the cow with its soft mouth is able to demolish and graze these tall sedge-like growths varies with the individual. Some animals favour pulling the canes from the base while others take hold of the leaves almost at the tips. Either method appears to be equally easy to stock and causes them no inconvenience whatever.

Perhaps the feeding of pampas may be extended to cover supplementary requirements of early spring when stock tend to scour—for which it is an antidote—and late summer when the pasture tends to be overloaded with clovers and therefore requires balancing with a diet less rich in protein and still palatable, which pampas certainly is. The feeding of excess of protein is wasteful and, some authorities hold, injurious (see this "Journal," February, 1929, p. 97).

Mr. C. R. Taylor in going through the pumice country has taken the opportunity of inspecting shelter-belts of pampas, and finds them regularly grazed every winter by stock leaving good pasture to do so. He concludes that pampas has an economic value hitherto undreamed of and a definite place in every farm in the future.

By H. W. BALL, Assistant Experimentalist.

LAST July rains throughout the chief farming areas were of considerable benefit to all primary producers. Early wheat crops are now well established, and in many instances could not look better. The July falls, together with the storm rains received on 10th August, assured a successful winter season and came at a most opportune time to permit the planting of potatoes and onions below the Range, and also greatly assisted the working of land for all spring crops. The Central-west and South-western districts also benefited considerably, so that pastoralists in those areas are now assured of a good spring.

Maize.

Large areas are being prepared for the sowing of early maize as conditions are generally favourable for seeding operations. From a grain production point of view the early maize crop is always a risky one, but if seasonal conditions warrant it can always be profitably utilised as fodder or silage, and is therefore never a complete loss. This Department's stocks of Funk's 90 Day, Golden Beauty, and Star Leaming pure seed maize are now exhausted, but supplies of Reid's Yellow Dent and Improved Yellow Dent are still on hand.

Wheat.

Prospects for the 1934-35 crop are now greatly improved. Late sown areas have responded well to the favourable conditions, so that given average rains during September and October an excellent yield is

indicated. Chiefly owing to drought conditions in the United States of America and Canada, wheat prices have developed an upward trend and are now higher than at any time since August, 1930. There is every indication that the improvement will hold, as under-average crops are forecasted in many exporting and consuming countries, thus diminishing further the accumulated world surplus and paving the way for an improved basis of future trading. The Queensland Wheat Board does not consider that a Commonwealth Pool would be in the best interests of growers in this State, but that greater material advantage would be

Plate 190.—A Crop of "Currawa" Wheat, Darling Downs.

"Mountain or river or shining star,
There's never a sight can beat—
Away to the skyline stretching far—
A sea of the ripening wheat."

obtained by the establishment of State Pools to deal with local consumption and co-operating as far as possible in the stabilisation of prices from year to year, leaving the matter of export to be dealt with by a Commonwealth body. Cheques covering the payment of the first advance of the wheat bounty granted by the Federal Government are now being posted to growers, payment being made on the acreage basis.

Peanuts.

Queensland's second largest peanut crop has recently been harvested, over 3,000 tons being delivered to the silos. This quantity should easily meet Australian requirements. Growers are naturally disappointed at the statement recently issued by the Tariff Board, that no increase in the general tariff rates on peanuts could be granted, as they consider the present duty inadequate to protect the industry from the importations of nuts in shell, and of the lower-grade nuts used for oil extraction. There is no doubt that Queensland is now producing a high-grade nut suitable for both household and manufacturing purposes. Peanut cultivation is now centred in the South Burnett, but is increasing in the Central and Northern districts.

PLATE 191.—ANOTHER CROP OF "CURRAWA" WHEAT AT KINKORA.

". . . with a feelin' like content,
An' I feel like thankin' Heaven for a day in labour spent."

Tobacco.

"*The Tobacco Industry Protection Act of* 1933" came into operation as from 12th July last. This Act provides for the registration of tobacco growers, sellers of tobacco seed and seedlings, and for the destruction of old plants subsequent to harvest. Tobacco districts and pure seed areas are also defined. The chief object is to secure greater

PLATE 192.—A FIELD OF "FLORENCE" WHEAT, DARLING DOWNS.

"And the breeze sweeps o'er the rippling rows,
Where the quail and skylark nest."

control over the pests and diseases that are the chief factors in retarding the progress of this promising new industry. Registration forms are being prepared and will be posted to all growers as soon as possible. Northern sales, held late in July, disposed of 54 tons of leaf, some of which was 1933 stock. The average price received was 2s. 6d. per lb., several parcels bringing 4s. At Dalgety's sale, held in Brisbane on 16th August, 86 tons were offered, representing the principal tobacco-growing areas in the North, namely, Dimbulah, Mareeba, Woodstock, Charters Towers, Bowen, Koumala, Miriam Vale, Sarina, and also the south-western districts of Texas, Yelarbon, and Inglewood. As the offerings comprised a larger proportion of medium and inferior grades than in previous sales the average prices realised were lower. The top price, 4s. per lb., was paid for attractive lines from Dimbulah, Bowen, and Charters Towers.

Dairying.

All dairymen are advised to get on the roll and vote "Yes" in the forthcoming ballot under the Commonwealth Dairy Produce Act for the Dairy Produce Equalisation Plan. Owing to increasing production and the uncertain overseas markets, it is generally considered that without such a plan in operation butter prices in Australia will reach a lower level than ever before, probably falling to London parity, which would be disastrous for the producers.

WARTS—A COMMON UDDER TROUBLE.

Warts, which are really small tumours, occur frequently on the udder and teats of the cow. They are seen more often in young than in old cattle. There is some evidence to indicate that they may be infectious. When numerous, they make the process of milking difficult, and as a result of the friction, particularly in stripping, they may result in sore teats. Warts are of different shapes, some are rather long and have a distinct neck, others are flattened, whilst others again are cylindrical in shape. Sometimes they will disappear spontaneously, but usually treatment is necessary.

Treatment is preferably carried out when the cow is dry. Actual removal by surgical methods provides the best means of treatment. Where warts are flattened and extensive, the operation should be carried out by a veterinary surgeon, but where they are of such a nature as to be easily snipped off with scissors, this can be done by the farmer himself. After washing the teat to remove all dirt, it should be immersed in a vessel containing weak disinfectant for some minutes, before the operation is carried out. Bleeding is usually slight and may be controlled by the application of "white lotion," made up of ¾ oz. sulphate of zinc, 1 oz. acetate of lead, and 1 pint boiled water. A white deposit will form in the bottle when it is allowed to stand. The bottle should be well shaken before the liquid is used. For safety the bottle should be labelled "Poison."

The application of various medicaments will frequently remove warts without recourse to surgical means. For this purpose castor oil applied several times daily, caustic solutions, and acids have been used with success. When strong caustics or acids are employed a ring of vaseline should be placed round the wart so that the material applied will not spread and scald the surrounding skin. Treatment of warts by the application of the preparations mentioned requires preseverance, since removal in this way is slow.

AGRICULTURE ON THE AIR.

Radio Lectures on Rural Subjects.

Arrangements have been completed with the Australian Broadcasting Commission for the regular delivery of further radio lectures from Station 4QG, Brisbane, by officers of the Department of Agriculture and Stock.

On Tuesdays and Thursdays of each week, as from the 4th September, 1934, a fifteen minutes' talk, commencing at 7.15 p.m., will be given on subjects of especial interest to farmers.

Following is the list of lectures for September, October, November, and December, 1934:—

SCHEDULE OF LECTURES.

BY OFFICERS OF THE DEPARTMENT OF AGRICULTURE AND STOCK, RADIO STATION 4QG, BRISBANE (AUSTRALIAN BROADCASTING COMMISSION).

Tuesday, 4th September, 1934—"Seasonal Farm Crops," Part I. By C. J. McKeon, Instructor in Agriculture.

Thursday, 6th September, 1934—"Seasonal Farm Crops," Part II. By C. J. McKeon, Instructor in Agriculture.

Tuesday, 11th September, 1934—"Seasonal Farm Crops," Part III. By C. J. McKeon, Instructor in Agriculture.

Thursday, 13th September, 1934—"The Tobacco Industry Protection Act of 1933." By H. S. Hunter.

Tuesday, 18th September, 1934—"Some Requirements of Plant Growth." By E. H. Gurney, Agricultural Chemist.

Thursday, 20th September, 1934—"Fertilizers and Manures." By E. H. Gurney, Agricultural Chemist.

Tuesday, 25th September, 1934—"Nutritive Value of Pasture." By E. H. Gurney, Agricultural Chemist.

Thursday, 27th September, 1934—"Mineral Ingredients in Stock Foods." By E. H. Gurney, Agricultural Chemist.

Tuesday, 2nd October, 1934—"Mammitis, a Disease of Dairy Cows." By K. S. McIntosh, H.D.A., B.V.Sc., Government Veterinary Surgeon.

Thursday, 4th October, 1934—"Worms in Pigs." By F. H. S. Roberts, M.V.Sc., Entomologist.

Tuesday, 9th October, 1934—"Feeding the Growing Pig." By L. A. Downey, Instructor in Pig Raising.

Thursday, 11th October, 1934—"Housing and Management of Pigs." By L. A. Downey, Instructor in Pig Raising.

Tuesday, 16th October, 1934—"Insecticides," Part I. By R. Veitch, B.Sc., F.R.E.S., Chief Entomologist.

Thursday, 18th October, 1934—"Insecticides," Part II. By R. Veitch, B.Sc., F.R.E.S., Chief Entomologist.

Tuesday, 23rd October, 1934—"Insecticides," Part III. By R. Veitch, B.Sc., F.R.E.S., Chief Entomologist.

Thursday, 25th October, 1934—"Insect Pests of Ornamental Trees." By A. Brimblecombe, Assistant to Entomologist.

Tuesday, 30th October, 1934—"Worms in Poultry." By F. H. S. Roberts, M.V.Sc., Entomologist.

Thursday, 1st November, 1934—"Black Spot of Citrus." By L. F. Mandelson, B.Sc. Agr., Assistant Plant Pathologist.

Tuesday, 6th November, 1934—"Marketing Pigs," Part I. By E. J. Shelton, H.D.A., Senior Instructor in Pig Raising.

Thursday, 8th November, 1934—"Marketing Pigs," Part II. By E. J. Shelton, H.D.A., Senior Instructor in Pig Raising.

Tuesday, 13th November, 1934—"Red Scale of Citrus." By W. A. T. Summerville, M.Sc., Assistant Entomologist.

Thursday, 15th November, 1934—"Care and Management of Growing Poultry Stock." By P. Rumball, Poultry Expert.

Tuesday, 20th November, 1934—"Dairy Problems No. 1." By F. J. Watson, Dairy Instructor.

Thursday, 22nd November, 1934—"Dairy Cattle Breeding." By C. F. McGrath, Supervisor of Dairying.

Tuesday, 27th November, 1934—"Butter Defects." By G. H. E. Heers, Senior Grading Inspector.

Thursday, 29th November, 1934—"The Care of the Foot of Domestic Animals." By J. A. Rudd, L.V.Sc., Director, Animal Health Station, Yeerongpilly.

Tuesday, 4th December, 1934—"Mineral Defficiency—a Common Disease of Farm Animals." By K. S. McIntosh, H.D.A., B.V.Sc., Government Veterinary Surgeon.

Thursday, 6th December, 1934—"Strangles in Horses." By J. A. Rudd, L.V.Sc., Director, Animal Health Station, Yeerongpilly.

Tuesday, 11th December, 1934—"Pineapple Fruit Rots." By H. K. Lewcock, M.Sc., Assistant Plant Pathologist.

Thursday, 13th December, 1934—"Dairy Problems No. 2." By F. J. Watson, Dairy Instructor.

Tuesday, 18th December, 1934—"Herd Recording." By L. Andersen, Senior Hèrd Tester.

Thursday, 20th December, 1934—"Dairy Problems No. 3." By F. J. Watson, Dairy Instructor.

PLATE 193.—KINGAROY FROM THE TOP OF THE PEANUT SILO, LOOKING NORTH OF WEST.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Guernsey Cattle Society, production charts for which were compiled for the month of July, 1934 (273 days period unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORN.			
	MATURE COW (OVER 5 YEARS), STANDARD 350 LB.			
Kilbirnie Ethel 3rd (365 days)	Macfarlane Brothers, Radford	18,108·4	829·29	Mowbray of Barbalara
Mabel of Sunnyview	J. Phillips, Wondai	13,564·3	526·772	Diamond of Greyleigh
Favourite 6th of Oakvilla	W. Marquardt, Wondai	13,082·38	518·709	Victory of Greyleigh
Nita 8th of the Cedars	W. J. Barnes, Cedar Grove	12,748·16	492·161	Red Knight of Greyleigh
French View Lady May	S. H. Teese, Veresdale	11,642·1	456·889	Chermside of Thornleigh
Westbrook Violet 8th	C. O'Sullivan, Greenmount	11,532·64	452·170	Sheik of Upton
Rhodesview Beauty 4th	W. Gierke and Sons, Helidon	11,459·27	436·240	Birdwood of Blacklands
Ruby 2nd of Glen Allyn	G. Short, Malanda	9,107·25	400·534	Woodrow of Eacham Vale
Princess 7th of Oakvilla	H. F. Marquardt, Wondai	10,469·22	391·325	Victory of Greyleigh
Rose II. of Wilga Vale	A. E. Vohland, Aubigny	9,982·25	390·835	Brilliant of Wilga Vale
Rosemount Jumper 2nd	A. J. Bryce, Maleny	10,075·4	383·756	Victor of Oceanview
Stately 2nd of Bri Bri	W. Middleton, Cambooya	7,880·25	377·624	Lord Brilliant of Bri Bri
Marcheta of Happy Valley	R. R. Radel, Coalstoun Lakes	8,918·3	377·118	Molly's Hero of Glenthorn
Lavender 8th of Quarnlea	Lehfeldt Brothers, Kalapa	10,039·31	373·369	Lord Nelson of Blacklands
Shamrock of Happy Valley	R. R. Radel, Coalstoun Lakes	8,393	358·296	Molly's Hero of Glenthorn
	SENIOR, 4 YEARS (OVER 4½ YEARS) STANDARD 330 LB.			
Primrose 5th of Bri Bri	W. Middleton, Cambooya	8,017·5	386·924	Lord Brilliant of Bi Bri
Rosenthal Maggie 8th	A. Sandilands, Wildash	9,172	374·223	Sunrise 3rd of Rosenthal

Junior, 4 Years (under 4½ Years), Standard 310 Lb.				
Penrhos Phyllis	A. Sandilands	8,382	344·367	Coral Brae Bonnie's Charmer
Senior, 3 Years (over 3½ Years), Standard 290 Lb.				
Champion 12th of Oakvilla	H. Marquardt, Wondai	12,066·04	488·286	Victory of Greyleigh
Villa Maria Broady 5th	J. Buckley, Rose Hill	6,948·5	335·798	Villa Maria Sir Charles
Junior, 3 Years (under 3½ Years), Standard 270 Lb.				
Oakvilla Princess 11th	H. F. Marquardt, Wondai	9,386·24	403·493	Gordon of Swanlea
Amiens' Emblem	B. Carter, Gleneagle	8,960·45	330·54	Empire of Springdale
Senior, 2 Years (over 2½ Years), Standard 250 Lb.				
Robina of Sunnyview	J. Phillips, Wondai	11,114·92	424·851	Lovely's Commodore of Burradale
Milstream May	W. J. Barnes, Cedar Grove	6,542·21	283·206	Whittier of Thornleigh
Primrose 8th of Bri Bri	W. Middleton, Cambooya	5,969·75	275·677	Majestic of Bri Bri
Jean 10th of Quarnlea	Lehfeldt Brothers, Kalapa	6,574·42	274·418	Nugget's Lad of Hillview
Junior, 2 Years (under 2½ Years), Standard 230 Lbs.				
Navillus Empress II. (272 days)	C. O'Sullivan, Greenmount	8,398·06	350·887	Midget's Sheik of Westbrook
Kingsdale Alice 27th	A. A. King, Mooloolah	7,318·35	316·382	Express of Burradale
Morden Nina 15th	R. Mears, Toogoolawah	6,990·95	306·482	Jupiter of Morden
Sunnyview Gem II.	W. L. Burnett, Brookfield	8,219·44	286·94	Lovely's Commodore of Burradale
Kyabram Daphne	A. H. Black, Kumbia	6,090·3	277·982	Ledger of Greyleigh
Royston Melba 3rd	T. G. O'Maara, Humphrey	7,050·15	272·297	Phœnix of Springdale
Colulu Phyllis	J. Bambling, Gunalda	6,053·3	257·193	Cooee of Bellwood
Sunnyview Nellie 6th	W. L. Burnett, Brookfield	5,819·28	253·418	Lovely's Commodore of Burradale
Navillus Model III.	C. O'Sullivan, Greenmount	6,594·51	252·077	Midget's Sheik of Westbrook
Worangg Frances III.	R. Ray, Yargullen	4,878·9	230·028	Rosenthal's Roseleaf's Dividend
JERSEY.				
Mature Cow (over 5 Years), Standard 350 Lb.				
Golden Fairy of Burnleigh	Chas. Klaus, Mundubbera	6,845·5	378·29	Noisy Jim of Burnleigh
Glengarry Mabel 2nd	J. and R. Williams, Crawford	6,857·2	361·103	Mike's Viscount of Kelvinside
Silver Wattle of Burnleigh	Chas. Klaus, Mundubbera	6,815·5	356·237	Trinity Baron

Production Recording—*continued.*

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.				
Countess of Fernlea	Kittle Brothers, Gleneagle	6,244·5	336·26	Brookland's Gilded
SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.				
Greenstock Poppy	J. B. Keys, Gowrie Little Plains	8,842·11	417·186	Greenstock Commander
JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.				
Goulburn of Fernlea	Kittle Brothers, Gleneagle	6,945·3	340·413	Norwood Noble Boy
Glenmah Lady Viola	F. A. Maher, Moggill	5,538·4	289·593	Glenmah Victor's King
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.				
Bellefaire Bonaparte's Bon Bellette	F. J. Cox, Imbil	6,112·35	379·988	Bonaparte of Rozel
G. N. Rozel 5th	Cox Brothers, Maleny	4,591·1	264·849	Retford Royal Atavist
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.				
White Rose of Hamilton	J. Witton, Raceview	5,988·98	375·075	Retford May's Victor
Eastland's Ginger Princess	T. Bourke, Dallarnil	4,328·9	279·405	Cornelius Prince of Rosedale
Glenmah Victor's Queen (270 days)	F. A. Maher, Indooroopilly	4,941·9	275·331	Retford Victor's Noble
Dassie of Billabong	J. Mollenhauer, Moffatdale	5,393·91	257·935	Premier of Calton
G.. M. Foxglove 4th	Cox Brothers, Witta	4,441·7	252·491	Retford Royal Atavist
GUERNSEY.				
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.				
Laureldale Rosette	W. A. Cooke, Maleny	6,639	320·141	Linwood Favour
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.				
Laureldale Honour	W. A. K. Cooke, Maleny	5,954·85	266·918	Linwood Favour

PLATE 194.—REPRESENTATIVE PIG BREEDERS.

A deputation representative of the Queensland Branch, Australian Stud Pig Breeders' Society, to the Minister for Agriculture and Stock, Brisbane, 10th August, 1934. The deputation discussed with Mr. Bulcock many matters of importance to breeders, and thanked him for his practical efforts to assist the industry. Front row, left to right.—E. J. Shelton, Miss M. Patten (Department of Agriculture and Stock), R. Turpin, Hon. Frank W. Bulcock, Mrs. A. Alford, Miss J. Handley. Back row.—Messrs. Manning (rep. H. B. Kerner), J. Barkle, Mat. Porter, J. Gamble (rep. G. W. Winch), P. V. Campbell (President), J. C. Henderson, G. Handley, A. F. Gray (N.S.W.), R. V. Hamilton, T. J. Collins (N.S.W.).

Answers to Correspondents.

BOTANY.

The Coconut.

M.A.J. (Tewantin)—

We have no pamphlet for distribution dealing with the planting, growth, and cultivation of the Coconut Palm and the processes of making copra. Coconuts should be planted in nursery beds and either put upright in the soil with the pointed end downwards and buried at least two-thirds in the ground, or they may be planted on their side, a portion of the nut being left above the surface of the soil. Germination generally takes place in from four to eight months, and when they are anything from 2 to 4 feet high the young palms can be transferred to their permanent positions.

Various methods of planting are employed on different plantations, but about 25 feet apart all round, allowing 70 to 80 plants to the acre, has been found satisfactory. Keeping down weed growth in plantations is rather difficult, but it is usual to grow a cover crop, generally of some legume. The cover crop is usually of a creeping nature, such as the Black Mauritius Bean or similar plant.

The nuts for copra making are either sun-dried or kiln-dried, but as most of the nuts are grown in countries with a heavy rainfall and very humid conditions, oven-drying or kiln-drying is generally resorted to.

You are rather far south for the successful cultivation of coconuts for commercial purposes, and owing to the present very low price of copra and the enormous supplies available, it is not considered that the establishment of fresh plantations, even under the most favourable conditions, is warranted at the present time.

Curly Mitchell Grass. "Tar Vine."

R.D.L. (Nelia)—

The specimen of Mitchell Grass represents *Astrebla lappacea*, the Curly Mitchell Grass. This is the commonest species in Queensland, and, generally speaking, we think, can be regarded as the best. It retains a certain amount of food value even when dried. Regarding a lick to supply deficiencies, the Agricultural Chemist has made several analyses of this grass at different times of the year, and he will reply to you direct regarding a lick to supply the deficiency in the pasture, particularly the winter pasture.

The vine sent under the name of Tar Vine is *Boerhaavia diffusa*. This vine is widely spread throughout Queensland and the Northern Territory, and is regarded as being of high fodder value. Your notes on it were appreciated.

Grasses of the Gladstone District.

G.S. (Gladstone)—

There are probably about 100 native grasses in the Gladstone district. These include different sorts of Panic Grasses, Star Grasses, Love Grasses, Spear Grasses, and others.

The usual practice with the Grass and Fodder Clubs of State Schools is for the members to collect small samples and forward them for identification and report. We would advise you to follow this course during the coming season. Of grasses a few seed heads should be sent, and where possible one stalk should be pulled up from the roots and doubled backwards and forward so that it can roll comfortably into a piece of newspaper.

Where more than one specimen is sent, each should be numbered and a duplicate retained, when names corresponding to numbers will be returned. Of weeds, fodder plants, &c., a shoot a few inches long bearing either flowers or seed pods should be sent. It can either be forwarded fresh or can be pressed flat between sheets of ordinary newspaper for a few days or until it is quite dry before sending.

Mossman River Grass.

K.C. (Cairns)—

The specimen is *Cenchrus echinatus,* a burr grass that is a native of Tropical America, but now found as a weed in most tropical and subtropical countries. It is quite common in Northern Queensland and is sometimes known as the Mossman River Grass. Stock will eat it to about the same extent as they will the Bunch Spear Grass, and consequently it has some value, although it is very objectionable on account of the wealth of burrs it sheds, and where it will grow we should think better grasses could be planted.

Frangipanni.

W.E.K. (Chillagoe)—

Although Frangipanni is an extremely common plant in Queensland gardens, we have no record of it causing severe pain and temporary blindness if the sap gets into the eyes, like that of Mistletoe Tree and Poinsettia. In most of these plants with a milky sap, however, the sap has a blistering effect, and we should say that if the Frangipanni sap did get into the eye it would cause pain and blindness perhaps for anything from an hour or two to a couple of days. Although the Frangipanni is widely cultivated in tropical countries we can find no reference in literature, either in India or elsewhere, to the sap having caused blindness in human beings or stock. The only reference we can find to the sap is that in Bengal it is used as a purgative. Personally, if ordinary precautions are observed, we can see no objection to cultivating the tree.

Weir Vine.

L.G.W. (Roma)—

As you suggest the Weir Vine is a native of Queensland. Its botanical name is *Ipomaea Calobra,* the specific name being taken from the common aboriginal one for the plant in parts of the West. The vine is very closely allied to the sweet potato, and several white residents have told us that they have used the underground tubers as a substitute for yams or potatoes and found them moderately good eating. Others have informed us that they have chewed portions of the underground tubers to allay thirst.

The poisonous principle is unknown, but apparently resides in the green parts of the plant and if anything seems most abundant in the green seed pods. The isolation and identification of these rather vague poisonous bodies in plants by ordinary chemical analysis is a very difficult matter.

Emu Grass. Blue Panic.

W.G. (Dalby)—

The specimen represents *Psoralea tenax,* sometimes known as Emu Grass and sometimes as Native Lucerne, although this latter vernacular is applied to a number of leguminous plants in Queensland. It is an extremely valuable fodder plant, and worthy of every encouragement where it is growing. Sometimes stock do not take to it very readily, but once they get a liking for it they eat it freely and the plant is very nutritious.

Regarding Blue Panic, we think you would be well advised to try a plot of this grass in your district. We are rather inclined to regard Blue Panic in your district as suitable more particularly for small paddocks, say 3 to 5 acres, for periodical feeding off.

Ellangowan Poison Bush.

J.K.G. (Clifton)—

The specimen is, as you said, the Ellangowan Poison Bush (*Myoporum deserti*), a shrub widely distributed in Queensland and one long suspected of poisoning stock. Feeding experiments recently carried out confirmed the popular belief. Acute constipation and intense inflammation of the digestive tract are features of Myoporum poisoning. Most of the trouble experienced in Queensland has been from travelling stock.

General Notes.

Staff Changes and Appointments.

Mr. L. Moriarty, Inspector of Dairies, Clifton, has been appointed also an Inspector under the Slaughtering Act.

Mr. D. L. McBryde, of Tully Sugar Mill, Tully, has been appointed Assistant Technologist, Bureau of Sugar Experiment Stations, Department of Agriculture and Stock.

Mr. K. V. Henderson, Cotton Field Assistant, Monto, has been appointed Instructor in Cotton Culture.

Mr. F. H. Gilmore, South Johnstone, has been appointed Millowners' Representative on the South Johnstone Local Sugar Cane Prices Board in lieu of Mr. A. A. Moule, resigned.

Mr. H. Le Gay Holthouse has been appointed Assistant Cane Tester at the Invicta Sugar Mill as from 26th July, 1934.

Mr. P. A. Kelly, Inspector of Dairies, Oakey, has been appointed also an Inspector under the Diseases in Stock Acts.

Mr. R. Ferguson, Inspector of Stock, Beaudesert, has been appointed also an Inspector of Dairies.

Mr. W. A. Kearney, Inspector of Stock, Slaughtering, and Dairying, has been transferred from Cloncurry to Mount Isa.

Mr. R. E. Watson, Inspector under the Dairy, Stock, and Slaughtering Acts, has been transferred from Brisbane to Toowoomba.

Pineapples—Maturity and Colour Standards.

A regulation has been issued under the Fruit and Vegetable Act providing for Maturity and Colour Standards for pineapples. In future, matured pineapples shall be fully developed fruit, which, during the months of November to one side at the bottom grooved or relieved to the width and thickness of the lacing sugar content of not less than 12 per cent., and during April to October is quarter yellow coloured at the base and contains a total sugar content of not less than 10 per cent.

The Cheese Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts, extending the operations of the Cheese Board from 1st August, 1934, to 7th February, 1935, and extending the term of office of the present members of the Board for a similar period. The members of the Board are:—Messrs. H. T. Anderson (Biddeston), Chairman; T. Dare (Narko), A. J. Harvey (Pittsworth), D. G. O'Shea (Southbrook), A. Pearce (Coalstoun Lakes), and E. Graham (Director of Marketing). No petition was received on the question of the continuance or otherwise of the Board for the period in question.

Pentland a Pure Seed Tobacco District.

An Order in Council has been issued under the Tobacco Industry Protection Act, constituting a Pure Seed District for Tobacco at Pentland. Tobacco is not now grown commercially in this area, and it will be used for the raising of pure seed.

Primary Producers' Organisation and Marketing Acts—Signing of Official Documents.

Regulation No. 77A under the Primary Producers' Organisation and Marketing Acts provides that agreements and official documents connected with the business of a commodity board shall be signed by the Chairman or Deputy Chairman, and countersigned by the Secretary. Occasionally, difficulty has been experienced in obtaining the signature of the chairman or secretary to a paper, owing to the absence of either on leave or business out of the State, and to meet the position a new regulation has been issued to-day, which will provide that documents shall be signed by the chairman or deputy chairman, or in the absence of both by any two members of the Board, and countersigned by the secretary, or in his absence by a member (not being a member who has already signed).

City of Brisbane a Sanctuary under Animals and Bird Acts.

An Order in Council has been issued under the Animals and Birds Acts declaring the City of Brisbane to be a sanctuary for the protection of native animals and birds. It will be an offence, in future, for any person to take or kill any animal or bird within the boundaries of the city of Brisbane.

Amendment of the Dairy Products Stabilisation Act.

An Order in Council, issued under the Dairy Products Stabilisation Act, further amends that Act in certain particulars. A "quota" is now defined to be the proportion of any dairy product manufactured during any stated period by a manufacturer within the State that such manufacturer is permitted to sell in the course of his intrastate trade or commerce in this State.

A "stated period" is defined to include a period of time mentioned in the Act or in any public notice by which a quota is promulgated.

It was previously provided that a quota would remain in force until it was succeeded by a subsequent quota. It is now provided that a quota will remain in force for the period provided for in the notice promulgating it.

It is further provided that the promulgation of a new quota shall not affect the legality of anything done under a previous quota.

It was also provided that no manufacturer should sell in excess of his quota. The amendment of the section relative to this sets out in fuller detail this restriction.

Further amendments provide for business done at Board meetings, and for the fixing of deputies.

Better Boar Subsidy Refund Scheme Terminated—New Scheme in Operation.

The Better Boar Subsidy Refund Scheme in operation over the period, August, 1933, to 30th June, 1934, attracted considerable attention throughout Queensland and resulted in a wide distribution of pedigreed boars in the Large and Middle White breeds, and in increased interest in the development of more extensive outlets for Queensland pork in the markets of the United Kingdom.

This scheme terminated on 30th June, 1934, and has been replaced by a scheme fostered by the Rural Assistance Board of the Agricultural Bank. Under this scheme the Board, acting in co-operation with the Agricultural Bank and Department of Agriculture and Stock, advances on loan 50 per cent. of the landed cost of boars, four months to two years of age, in the following breeds:—Large White, Middle White, Tamworth, and Berkshire.

Forms of application are now available and may be obtained by writing to the Department of Agriculture and Stock, Brisbane, or to the Agricultural Bank. The loan is repayable on easy terms over a period of two years, subject to satisfactory arrangements being completed on receipt of the application form properly completed and accompanied by a fee of 5s., payable to the Rural Assistance Board, Agricultural Bank, Brisbane.

Registration of Stallions.

The Minister for Agriculture and Stock (Mr. F. W. Bulcock), in referring to recently published press statements dealing with the registration of stallions, desires to make it clear that existing legislation definitely prescribes that all stallions three years of age and upwards are required to be produced for examination by the Stallion Board.

Annual certificates are issued to horses of three and four years of age passed as sound and of approved type, and life certificates are granted for approved, sound five-year old horses.

The proposed amendment of legislation would provide for the examination and life certification of sound and approved blood horses at five years of age. If a horse is intended to be used for service prior to that age, it would be necessary to have him produced for examination. The variation proposed will, in effect, exempt all horses in training and under the age of five years from examination under the Stallions Registration Acts, but it would be necessary to produce for examination at one or other of the advertised parades all blood horses of five years of age and upwards not already submitted for examination.

The Minister desires it to be definitely understood that any variation in existing legislation outlined above would not apply to draught stallions.

Barley Board.

Messrs. Edward Fitzgerald, of Felton, and Henry Kessler, Cambooya, have been re-elected unopposed for a further term of one year as from the 1st October next, as members of the Barley Board.

Rural Topics.

Calf-Rearing.

In the rearing of calves it is important that they be fed separately. The practice of feeding in tubs or troughs must be strongly condemned, because it allows the fast drinkers to get too much milk at the expense of the slower ones. It also tends to make young animals drink faster than they should, which gives rise to digestive troubles. Slow drinking should be encouraged, because it allows the milk to combine in proper proportions with the saliva and assures thorough digestion. Proof of this is shown by the fact that slow drinkers always grow best, provided, of course, that they are given their full ration of milk. Moreover, it is impossible to cleanse a trough thoroughly, and as a consequence it is a common cause of scours—more particularly when made of wood or a hollow log.

Money is well spent in the erection of proper yards and bails for calf feeding, much time and temper being saved thereby. Too often there is an entire lack of convenience for this important work which is carried out twice every day.

Nutrition and Wool Growth.

Uniformity and strength of wool fibre depend on adequate nutrition. Malnutrition of the sheep leads to improper function of the wool follicle so that only a slender weak wool fibre is produced. This fibre may be so weak that on the wool coming through the skin it immediately breaks. Thus, any sudden deprivation or lowered nutrition is reflected by a tenderness or actual break in the wool produced at that time. Continued lowered nutrition is accompanied by the production of wool which is finer than normal and tender. Lack of character is often the result of an impaired nutrition.

Thus in drought years wool is what is termed "hungry fine," and is often tender. Sheep which have had their nutrition lowered by attack by internal parasites similarly may produce a tender wool. It may even show a break, this coinciding with the period when the parasites were exerting their greatest effect. Similarly, ewes rearing lambs may show a tender fleece, whereas other ewes of the flock, but not rearing lambs, i.e., dry ewes, have a sound well-grown wool.

Breaks in the wool are also brought about by a sudden change in feed, as, for example, when poverty-stricken sheep are suddenly placed on good feed.

Pig Paddocks and Pastures.

That the pig is instinctively a clean animal and does not require any elaborate or expensive housing or attention is now very well known and appreciated by all who have made a success of the breeding, feeding, and management of this class of live stock.

It is essential to success in rearing pigs that the premises in which they are kept be clean, dry, and free from draughts, and that the pasture over which they graze be clean and well supplied with sufficient herbage of a succulent nature.

Pig houses should not be cramped low or dark and evil smelling, but should be well constructed, be high enough to enable a person to move about inside for purpose of cleansing and care of the stock, and be open to the sunlight to such an extent as to be warm and dry in winter time and cool and airy in the summer.

Portable shelter sheds are much to be preferred for paddock use, also portable feeding floors and troughs, for these enable the paddocks to be kept in good condition, and they eliminate risk of danger to pasture and crops. Careful handling and efficient management go hand in hand, and the successful pig raiser is the one who studies all these features and keeps himself up to date.

These points are emphasised in the pamphlet, "The Pig Farm," by L. A. Downey, Instructor in Pig Raising, now obtainable at the Department of Agriculture and Stock, Brisbane.

Dentition of the Pig.

As a general rule it is not customary in farmyard routine to depend upon inspection of the teeth in deciding upon the age of a pig, although the dentition test may be applied in case of valuable show animals with a fair measure of success. Full particulars in regard to dentition may be obtained by those interested upon application to the Department of Agriculture and Stock.

A full grown pig has twelve incisors or front teeth, six in the upper and six in the lower jaw, and two canine teeth in each jaw. There are also seven molars in each side of the upper and lower jaws, or a total of 44 permanent teeth in all.

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

MORE MILK FOR THE CHILDREN.

WE pointed out last month how important it is that our children should take sufficient milk to maintain their health and to insure sturdy development. Every child under six should take one pint daily and every child over six at least half a pint. It would be an immense benefit to the State if our present consumption of milk were doubled. This would also encourage our dairy farmers, a very hard-working class of men (including also their women and I fear often their children), who, we are informed, are in many cases not earning a basic wage.

Excellent milk might be supplied by contract to the schools in Brisbane at a price which would enable every child to have half a pint of milk for a penny with his other school lunch. This would entail no cost to the State. There might even be a small surplus. The distribution of the milk could be performed by senior scholars under the supervision of a teacher. This would be a lesson in order, discipline, and cleanliness. The children as a whole would enjoy better health and be better scholars. The other day a Brisbane mother wrote to us. She says, "I have two young children and pay a shilling a week for 2½ pints. My children have a long walk to school and one, who is studying for the scholarship, has a huge bag of books to lump, so I am reluctant to add bottles of milk. Why are school children so penalised? Why 6d. for 1¼ pints to the school children." Under this scheme her children would receive 2½ pints for 5d., or 5 pints for 10d.

Value of Pasteurised Milk.

The milk would be pasteurised and delivered in bulk. For such milk of excellent quality the Diamantina Hospital pays a little less than 1½d. a pint. Raw milk has often been a vehicle for the spread of infectious diseases. This risk may be prevented either by boiling or by pasteurising. For fifty years and more Brisbane mothers have been in the habit of boiling their milk, and have thereby saved their children from tuberculosis and other diseases derived from cow or the milkers or those who handle the milk. For one thing, tuberculosis of the spine and hipjoint have been much less common here than in the Southern cities, where the milk is boiled only in the hottest months. Therefore it is strange that there should be any prejudice against pasteurised milk, which is just milk that has been heated about half way to boiling point and kept at that heat for about half an hour. Nothing but pasteurised milk is used in the Brisbane Baby Clinics. What is good enough for infants and invalids should be good enough for anybody.

Benefit of a Daily Ration of Milk.

Perhaps it is necessary to quote some authoritative statements. From a leading article in the "British Medical Journal" of 24th February, 1934, we extract the following sentences:—"There is every reason to believe that a daily ration of milk given to children, particularly to those who are living on the borderline of under-nourishment, is likely to exert a beneficial action on their mental and physical development. That a large amount of disease is carried by raw milk is no longer an opinion; it is a fact—a fact as well attested as any in the domain of medical science. There do not appear to be any grounds for the belief that pasteurised milk is a less valuable component of the diet than raw milk for children, who satisfy the bulk of their nutritive requirements from sources other than milk. And again there are strong grounds for the belief that infants can satisfy all their requirements on diets of adequate amounts of pasteurised milk provided that extra vitamin D and of course vitamin C are added to the diet." The last sentence simply means that these infants should take small quantities of a codliver oil emulsion and of orange juice. The Medical Research Council of Great Britain in their report for 1932-33 states that "efficient pasteurisation of milk remains an essential second line of defence in safeguarding human health. The council are not aware of any trustworthy evidence that pasteurisation, if properly carried out, has any seriously damaging effect upon the nutritive qualities of the milk."

The low cost at the Diamantina Hospital depends on the milk being supplied in bulk and not in bottles, for at least half of the retail cost of milk is due to the cost of distribution. It would not be possible to obtain milk at this price, we fear, in our smaller towns, but something should be done there also to supply school children with good and cheap milk. The conditions in these towns are dissimilar and would need special investigation in each case. For the pre-school child the problem is also difficult. Many mothers need to be taught that to give their children only condensed milk or powdered skimmed milk in large quantities of water is a mere pretence of proper nourishment. All children of families on rations should be supplied with milk as a matter of course. This should, we think, be done also in the case of young children of families receiving relief wages.

The Useful Goat.

In country districts conditions vary widely. In dairying districts there is plenty of milk, but some families do not drink it, and their children suffer in consequence. In sugar-growing and fruitgrowing districts every farmer could keep a cow, and have abundance of milk for his family, but many think it too much trouble. Again, there are the dry districts with frequent droughts. Here the health of the children depends mainly on goat's milk, which costs no money in good seasons. Perhaps because it costs nothing when natural feed is plentiful, the goats are allowed to go dry whenever it is scarce. Very few feed their goats, even when mulga can be obtained at no cost, but that of personal exertion. In all these country districts the only thing needed is better education of the mothers.

IN THE FARM KITCHEN.

DRIED FRUITS AND THEIR USES.

Sun-dried fruits were known in olden times, for it is recorded in history that King David of Israel accepted raisins in payment of taxes; and down through the ages we find evidence that sun-preserved fruits were always considered valuable foods.

For health reasons, fruits and vegetables should appear every day in the menu of both young and old. It is not, however, always possible to obtain fresh fruit, and although dried fruits should not altogether take the place of the fresh article, they form an acceptable change in the daily diet. Dried fruits are deficient in vitamin C, but they add so much to the diet in the way of fuel, minerals, laxative properties, and palatibility, that one can easily make up their vitamin deficiency by other foods such as oranges and various raw vegetables.

COOKING DRIED FRUITS.

The flavour of the fruit is retained when it is cooked by the following method, while much less sugar is required for sweetening if it is added towards the end of the cooking. A few grains of salt will bring out the flavour of stewed apples; the salt should be added towards the end of the cooking.

1. Wash the fruit thoroughly in several waters.
2. Soak overnight in fresh water.
3. Cover the saucepan, and cook slowly until the fruit is tender.
4. Add sugar, if necessary, five minutes before the fruit is cooked.

SOME FAVOURITE RECIPES.

Steamed Ginger Fig Pudding (serves 8)—1 egg; 1 cup golden syrup; ½ cup melted fat; 1 cup minced figs; 1 cup hot water; 1 tablespoon ground ginger; 1 teaspoon bicarbonate of soda; 2½ cups sifted flour.

1. Beat eggs slightly, and add golden syrup and melted fat.
2. Add minced figs, and beat thoroughly.
3. Sift flour, ginger, and soda together.
4. Add this to the first mixture, alternately with 1 cup of hot water.
5. Beat thoroughly, and turn into a greased covered pudding mould.
6. Steam 3 hours, and serve with lemon sauce.

Lemon Sauce—1 egg; 1 cup sugar; one-third cup melted butter; 1 tablespoon flour; 1 teaspoon lemon extract.

1. Beat egg slightly in the top of a double boiler.
2. Add sugar, butter, and flour.
3. Beat until smooth, then add 1 cup boiling water and cook 5 minutes, stirring frequently.
4. Add lemon extract.
5. Serve hot over pudding.

Peach Coffee Cake—1 cup dried peaches; 2 cups sifted flour; ¼ cup sugar; 4 tablespoons butter; ¾ cup milk; 4 teaspoons baking-powder; ½ teaspoon salt; 2 teaspoons cinnamon; ½ cup yellow sugar; ¼ cup flour.

1. Wash peaches thoroughly, and cook until tender.
2. Remove the skins from peaches, and cut in strips ½ inch wide.
3. Sift 2 cups flour; ¼ cup sugar, baking-powder, and salt.
4. Work in butter with two knives until mixture resembles coarse meal.
5. Add milk gradually while stirring.
6. Beat well and put into a greased shallow pan.
7. Cover the top of the batter with the cut peaches.
8. Cover all with the following mixture:—Cream together 4 tablespoons butter, ½ cup yellow sugar, ¼ cup flour, and 2 teaspoons cinnamon.
9. Bake thirty minutes in a hot oven of 42 deg. F.
10. Serve with custard or any desired sauce.

Apricot Mousse (serves 6 to 8).—Two cups milk; 1 cup sugar; 2 tablespoons flour; 2 cups whipped cream; 2 egg-yolks; 1½ teaspoons gelatine; 1 cup cooked dried apricots.

1. Scald milk in a double boiler.
2. Mix sugar and flour thoroughly, and add to milk.
3. Pour mixture over two beaten egg-yolks, and return to double boiler to cook for two minutes or until mixture coats the spoon.
4. Soak gelatine in one tablespoon of cold water.
5. Add soaked gelatine to hot custard mixture.
6. When mixture is cold, add dried apricots which have been rubbed through a coarse wire sieve.
7. Add whipped cream and freeze.

If the pudding is not to be frozen, but simply set, use 1½ teaspoons of gelatine. —"South African Gardening and Country Life."

CORNISH PASTIES.

Materials.—For filling: ½ lb. topside steak or leg chops; ½ lb. potatoes; 1 small onion; 1 teaspoonful salt; ¼ teaspoonful pepper. For pastry: 6 oz. flour; 3 oz. dripping; ½ teaspoonful baking-powder; ½ gill water.

Utensils—Bowl; sieve; cup; board; rolling-pin; knife; basin, brush; baking tin.

Method—

1. Sift flour, baking-powder, and salt into a bowl.
2. Add dripping; rub it into the flour with the tips of the fingers.
3. Slowly add sufficient water to make dough; turn out on a floured board; knead lightly; cut into four pieces.
4. Roll out each piece into a circle.
5. Wash, peel, and cut potatoes into small cubes; cut meat up small; peel and chop up onion; mix these all well together, adding pepper and salt.
6. Divide into four portions; put one portion on each circle of pastry.
7. Wet half the edge of each circle; fold one-half of each circle over the meat on the other half; pinch the edges together, making a shell-like pattern by twisting the pastry slightly with the thumb and index finger.
8. Brush over with egg or milk; place on a flat tin in a hot part of the oven for 15 minutes; remove to a cooler part and bake for 30 minutes; serve hot.

PLUM PUDDING WITHOUT EGGS.

Materials—½ lb. flour; ¼ lb. suet; ¼ lb. sugar; ¼ lb. stoned raisins; ¼ lb. sultanas; 1 oz. candied peel; 1 teaspoonful mixed spice; ½ nutmeg; 1 teaspoonful carbonate of soda; 1 gill milk; ½ gill warm water.

Utensils—Bowl; sieve; knife; wooden spoon; teaspoon; cup; basin; greased paper or pudding cloth and string; steamer or large saucepan.

Method—

1. Sift flour and salt into a bowl; rub in finely-chopped suet.
2. Add sugar, stoned raisins, sultanas, chopped peel, spice, and nutmeg; mix well.
3. Add the soda dissolved in milk and water; stir until all the ingredients are thoroughly mixed.
4. (*a*) Pour into a well-greased basin; cover with greased paper; steam for 4 hours; or

   (*b*) Pour into the middle of a pudding cloth wrung out of boiling water and sprinkled with flour; tie up securely; put the pudding into a saucepan three parts full of boiling water; boil for 3½ hours.
5. Turn out on a hot dish; serve with boiled custard.

Note—For a date or fig pudding use cut-up dates or figs instead of sultanas, raisins, and candied peel, omit spice and nutmeg, and use ½ teaspoonful instead of 1 teaspoonful of carbonate of soda.

FRITTERS.

Materials—4 oz. flour; 1 dessertspoonful butter; white of 1 egg; 1 gill of warm water; dripping for frying; 8 small slices of cold cooked meat or fruit; 3 sprigs of parsley or 1 tablespoonful of sugar.

Utensils—Bowl; sieve; wooden spoon; small saucepan; basin; whisk; skewer; fish kettle or large saucepan; brown paper; dish.

Method—

1. Sift flour and salt into a bowl; make a well in the middle.
2. Pour in melted butter; add warm water slowly; stirring carefully until the flour, butter, and water are mixed into a batter.
3. Add the white of egg beaten to a stiff froth; stir gently.
4. Lift a slice of meat or fruit on a skewer; dip it into the batter; when completely covered drop it into deep hot smoking fat; repeat as often as necessary, watching those put into the fat first.
5. The fritters should float, and must be turned quickly when browned on the under side.
6. When golden brown all over lift them out on a skewer and drain them on paper.
7. Arrange piled up on a hot dish; if made with meat, garnish with parsley; if with fruit, sprinkle with sugar.

Notes—

1. Meat for fritters must be cooked, freed from fat and gristle, and cut into slices no thicker than ¼ inch.
2. Bananas must be cut into slices lengthways.
3. Apples must be peeled and cut into slices ⅜ inch thick across the core; the core must be cut out with a corer; the slices should be put into a shallow pan of boiling water and boiled for 3 minutes; a skewer should be used to turn the slices, and care must be taken not to break them.
4. Pineapples must be peeled and cut into slices ⅜ inch thick; the eyes and core must be carefully removed without breaking the slice; if the pineapple is very large the slices should be halved or quartered.

TRIPE AND ONIONS.

Materials—1 lb. tripe; 2 onions; 1 cup milk; 1 tablespoonful flour; salt and pepper; 1 dessertspoonful chopped parsley.

Utensils—Bowl; knife; 1 quart saucepan; 1 pint saucepan; colander or strainer; wooden spoon; basin; dish.

Method—

1. Wash the tripe in warm water; cut away the fat; cut tripe in small pieces.
2. Put the pieces into a saucepan; add enough cold water to cover tripe; put the saucepan on the fire.
3. Boil for 5 minutes; remove from fire; strain off water.
4. Peel and slice onions; put them into a saucepan; add enough cold water to cover them; bring to boiling point; strain off water.
5. Put the parboiled onions into the saucepan with the tripe; cover with cold water; boil till the tripe is tender; strain away half the water.
6. Add milk; bring to boiling point; thicken with flour blended with cold milk; boil for 5 minutes; season with salt and pepper.
7. Serve on a hot dish; sprinkle chopped parsley over the tripe before sending the dish to the table.

STEAK AND KIDNEY PUDDING.

Materials—For pastry: 6 oz. flour; 3 oz. suet; ½ teaspoonful baking-powder; ½ teaspoonful salt; ½ gill water. For filling: 1 lb. steak; 2 sheep's kidneys; 1 slice bacon; 1 tablespoonful flour; 1 teaspoonful salt; ¼ teaspoonful pepper; 1 teaspoonful chopped onion.

Utensils—Board; rolling-pin; bowl; sieve; knife; basin; cup; greased paper and steamer, or pudding cloth and string; large saucepan.

Method—

1. Sift flour, salt, and baking-powder into a bowl.
2. Rub in finely-chopped suet; work into a paste with water; turn out on a floured board; knead lightly.
3. Roll out to the thickness of ¼ inch; line a well-greased basin with part of the pastry.
4. Cut steak, kidneys, and bacon into small pieces; roll pieces in flour, pepper, and salt.
5. Put pieces in layers into the lined basin; sprinkle each layer with minced onion; pour in enough water to come up to 1 inch from the edge of the basin.
6. Cover with pastry; trim the edges with a sharp knife, cutting downwards; pinch the edges of the lining and covering pastry together.
7. (*a*) Cover the pudding with greased paper; steam it for 3 hours; or
   (*b*) Sprinkle with flour the middle of a pudding cloth wrung out of boiling water; tie the pudding cloth securely over the top of the pudding; put the pudding into a saucepan three parts full of boiling water; boil for 2½ hours.
8. Since the pudding cools quickly, it should be served in the basin in which it is cooked; a serviette should be pinned round the basin, and the basin placed on a dish before it is sent to the table.

LEMON MERINGUE.

Materials—½ pint milk; 1 cup bread crumbs; 2 eggs; 1 tablespoonful butter; 3 tablespoonfuls sugar; the grated rind and juice of 1 small lemon.

Utensils—Saucepan; basin; cup; plate; whisk; pie dish; grater; squeezer.

Method—

1. Put the milk into a saucepan; bring it to the boil; put bread crumbs into a basin.
2. Pour the boiling milk over the crumbs; add grated lemon rind, butter, and half the sugar; mix well; allow to cool.
3. Separate the yolks and whites of eggs; beat the yolks well; add them to the cooled mixture in the basin.
4. Pour the mixture into a well-greased pie dish; bake in a moderate oven until the pudding is set but not browned.
5. Whisk the white to a firm froth; add lemon juice and the remainder of the sugar, making a stiff meringue.
6. Pour the meringue over the pudding; return it to the oven till the meringue is set and slightly browned.

POTATO SCONES.

Materials—1 lb. boiled potatoes, sweet or English; 1 teaspoonful salt; 3 tablespoonfuls flour; ½ gill water.

Utensils—Board; rolling-pin; knife; cup; frying-pan or girdle.

Method—

1. Mash cold boiled potatoes; add salt and flour.
2. Mix well; add enough water to make the mixture into a dough.
3. Roll out to the thickness of ¼ inch; cut into squares or triangles.
4. Heat a girdle or frying-pan; sprinkle it with flour.
5. When the flour turns a creamy colour put the scones on the hot pan.
6. Cook for about 5 minutes; turn; cook the other side until it is slightly browned.

PRUNING OF TREES AND SHRUBS.

The following hints on the pruning of trees and shrubs were given by the Superintendent of the Botanic Gardens, Sydney, in the course of a paper read at the recent Central Coast conference of the Agricultural Bureau of New South Wales.

The object of pruning trees is to regulate the growth so that shapely specimens may develop. The first important matter in the pruning and training of young trees for specimens is to see that they are developed on a single straight stem or bole. This is done by seeing that the leading shoot is in no way injured, and is allowed to develop unhampered, by, if necessary, cutting away any side shoots that appear to be rivalling the main shoot for leadership. Where a clean bole is required for a certain height, the lower branches should be gradually cut away as the plant grows. Avoid cutting away too much at any one time, and try to do any cutting before the side branches are too large, because each cut makes a wound and the larger the wound the more likely, unless properly treated, that decay or disease will make its appearance. The top also may require a little thinning and shaping in the early stages to balance the tree.

In dealing with older trees where through accident or other cause it becomes necessary to remove some of the larger branches, the cut thus made, being a large one, should be properly treated at once, otherwise it becomes a settling place for parasitic diseases. When removing a large branch, do not attempt to cut it all away in one large piece, unless of course you have it slung; if you do you will probably find that its weight will tear away a portion you do not want injured and offer further harbour for parasites.

All limbs and large branches should be sawn off close to the trunk so that no stump, which will probably die back into the heart of the tree before the trouble is noticed, is left. If sawn off close to the trunk with a clean cut at about the level of the surrounding bark, the bark will eventually cover the wound, or at any rate form a callous around it and to a certain extent prevent decay.

Any cuts made should be treated immediately after being made with either gas or Stockholm tar or some such mixture, thus sealing the raw surface and protecting it from disease. This wound should be periodically treated if it shows signs of cracking or opening up.

Their pruning is one of the most important phases in the growing of shrubs. The art of pruning as applied to ornamental as well as flowering shrubs may be said to serve one or more of the following purposes—(1) To improve or alter the shape of the plant; (2) to increase the quantity or quality of the blossoms; or (3) to bring about an improvement in the health of the plant. Therefore its proper practice necessitates an intimate knowledge of the habits and nature of the subject to be operated on. For instance, a collection of flowering shrubs, in so far as they need pruning at all, cannot be pruned properly unless the workman knows the time of flowering of each one and other little peculiarities of growth.

Although the winter months are looked upon as the time for general pruning it must not be taken for granted that all shrubs can be pruned then. A very good rule with regard to all flowering shrubs is to prune at such a season as will allow of the fullest possible period of growth before the next flowering season comes around.

Those shrubs on which flowers are borne on the growth of the current year should be pruned in the winter before the growth commences. The previous year's wood may, if necessary, be cut hard back to make the plant more shapely. Then there are those that flower on the previous season's growth. These should not be cut back until immediately after flowering, which takes place in the spring or early summer months.

A few points to remember when pruning, assuming one knows the habits of the plants, are as follows:—Cut out all weak and spindly growth, and shorten back growths where necessary, but not in a formal fashion by just clipping the plant all around. Show as few cuts as possible and leave the plant in as natural shape as you can. Many of our deciduous shrubs and a few of the evergreens will stand cutting right back to the ground if circumstances demand such drastic action.

THE GARDEN COMPOST HEAP.

The garden compost heap is a cheap means of converting garden and household vegetable refuse into valuable fertilizing material. Materials such as lawn clippings, spent crops free of disease, vegetable tops, &c., should all be used in this manner, but the coarse, woody stalks of strong-growing plants should not be used.

The production of artificial manure from garden waste, straw, &c., consists in the decomposition, by fungi and bacteria, of much of the plant material. The nitrogen in the process is converted from an inorganic to an organic form, and is

present in increased amount in the material finally produced. The rapidity with which the process goes on is influenced by the type of material, its degree of maturity and chemical composition, and by the presence of nutrients such as lime, phosphate, nitrogen, and potash, for the organisms carrying on the decomposition are much akin to plants in their requirements.

Actual damage can be done to crops, other than some legumes, by the addition of uncomposted, poor-quality material to the soil. This damage is due largely to a lack of available nitrogen in the soil. Such poor-quality materials as bush scrapings, dry mature grass or straw, offer a good source of energy for the soil bacteria and fungi, which rapidly increase in numbers, and in so doing consume all the available nitrogen. This competition for soil nitrates results in the nitrogen starvation of crop plants.

The usual process of allowing plant refuse to decay without any chemical treatment results in a very acid product, providing no immediately available nitrogen. With nitrogen-poor plant residues it becomes necessary to add available nitrogen to the heap, as well as lime, which prevents the development of acidity, and prosphate, which is required in the nutrition of the organisms. With nitrogen and mineral-rich materials such as legumes (peas, beans, &c.), green vegetable tops, and other green succulent material, the use of lime alone should be sufficient to enable rapid decomposition.

With general refuse or poor-quality material, a heap can be made on a square base, and of such size that the final height is about 3 feet. Spread the chopped-up material in layers several inches deep, treating each layer in the following manner:—

Snow over with ground limestone (5 lb. per 100 lb. material), fork in loosely, give a sprinkling of superphosphate, and then add sulphate of ammonia at the rate of 1½ lb. per 100 lb. material. The material should be moistened before building up the layers, if not already moist. Ammonia may be given off slowly, so that it is necessary to keep building up and treating the successive layers quickly, so that it will not be lost. The final layer is not treated, and may be given a covering of an inch of soil. When next the heap is added to, the untreated layer can be moistened and treated.

When the heap is at the full height, after subsidence due to compaction and loss of material by bacterial action, the heap can ferment under the untreated capping, which can be used as a base for the next heap. The heap should be kept damp, but water should not be added in quantity sufficient to cause drainage from the heap.

In summer the material should be ready for use after two months, but in cold weather the process is much slower.

Artificial manure properly prepared is very similar in chemical composition to composted horse manure, and gives equally good results in promoting plant growth.

FERTILITY OF THE HOME GARDEN.

Intensive gardening demands a higher degree of soil fertility than does ordinary field crop culture. An efficient system of soil management should not only make allowance for the present crop, but should aim at an ever-increasing reserve of fertility. It should determine the necessity and value for the particular soil of organic matter, how most economically to apply this material, then attempt to supplement this where necessary, by liming and the addition of artificial fertilizers.

Organic matter has an important function in the growth of plants as a source of carbon dioxide, in improving the physical condition of the soil, in increasing the water-holding capacity, allowing root penetration, and modifying extremes of soil temperature. In addition to providing some of the mineral constituents required in greatest amount, organic matter provides certain rare and little understood elements, usually not considered in the preparation of artificial fertilizers. Heavy soils in which the fine particles accumulate in large masses, and crack badly on drying, can only be improved in texture by liming when acid, and the addition of organic matter to prevent the clods from cementing.

In general, the richer the food of animals in fertilizing substances the richer their excreta, particularly the liquid portion. This contains most of the potash and a great deal of the nitrogen, but only a small amount of the phosphate which passes through their bodies; further, it contains these substances in a form

ready for the immediate use of the plant. It is therefore important to realise that unless precautions have been taken to include it with the solid excreta, most of the valuable fertilizing constituents have been lost.

The kind of animal affects the fertilizing value of manure. Horse manure is richer and more readily decomposed than cow manure, since the mineral requirements of the milking cow are much greater than those of the horse. Poultry manure, when fresh, is a rich fertilizer compared with horse or cow manure; it contains more than twice as much nitrogen and phosphate, but has only about the same amount of potash. The bulk of its nitrogen is present in an easily available form, hence it is a quick-acting or forcing nitrogenous manure.

Animal manure as commonly procurable has not been carefully conserved against the loss of fertilizing constituents, and unless the liquid portion has been included, a considerable portion of the nitrogen present is not of use to plants. It must be regarded as an unbalanced fertilizer, and the fertilizer balance can be greatly improved by the separate use of superphosphate, and sulphate or chloride of potash.

Where the organic matter of the soil is maintained by using manure, a degree of fertility will be maintained, but an annual application of 100 to 150 lb. per 100 square feet will be necessary.

LIME FOR THE GARDEN.

Lime fulfils many functions which are essential to soil fertility. Its most useful action is in neutralising the acidity of strongly acid soils, for with the removal of acidity the other valuable effects of liming follow. Lime improves the physical condition of heavy acid soils, ensuring better drainage and aeration, and making cultivation easier, and is an essential plant nutrient, and when present in sufficient amount promotes many phases of bacterial activity, especially those ultimately bringing the reserves of nitrogenous material in the soil into the soluble forms of nitrogen which plants utilise.

There is no foundation for the common statement that exposure of acid soil to sun and air "sweetens" or reduces its acidity. Acidity is developed through an insufficiency of lime in the original soil-forming material, or by the loss of lime, through leaching, and absorption by plants. Acidity thus developed can only be counteracted in field or garden practice by the use of some form of lime. The forms of lime used for counteracting soil acidity are hydrated or slaked lime, and ground limestone or carbonate of lime.

Slaked lime is formed by the action of water on burnt or stone lime, and forms a very fine powder which can be efficiently spread. Ground limestone is a cheaper and more pleasant material to handle than slaked lime, and can nearly always be relied on to give as quick and good results as slaked lime, provided the material is sufficiently fine and well distributed, and that equivalent dressings are applied. In the last respect, 4 lb. of carbonate of lime are required to supply as much "effective" lime as 3 lb. of slaked lime contains.

The soil to be limed should be dug over and reduced to good tilth, the lime uniformly spread, and then lightly worked into the top several inches of soil. The amount of lime to be used depends on the degree of acidity of the soil, its texture, organic matter content, and the type of plant to be grown. Unless all these features can be determined, suggestions on the amount of lime that it is necessary to add to a soil can only be approximate.

On loams and heavier soils, dressings may range from 1 lb. of slaked lime, or 1½ lb. ground limestone, per square yard on loams, to double these quantities on clay loams and clays. Sandy loams or still more sandy soils can receive lighter dressings of approximately half the amount for loams. Lime is lost most rapidly from sandy soils, which are usually more acid than heavier soils under the same conditions. Under garden conditions, with frequent waterings, lime is continually being lost, especially from the sandier types of soil. After the initial liming, which may need to be heavy to counteract strong acidity, it is preferable to add light dressings each season, rather than occasional heavy dressings.

It is not always necessary to add sufficient lime to completely neutralise soil acidity, as most garden plants grow well on slightly acid soils. This slightly acid condition will only result in the majority of garden soils after liming. Only

for those plants listed below as very sensitive to acidity is it advisable to completely neutralise acidity. Whilst many plants grow best on neutral soils or on slightly alkaline (opposite of acid) soils, a considerable number of plants will tolerate fairly acid soils. The latter are not adversely affected by being grown in limed soils, though many plants which require a good lime supply may fail on acid soils.

By careful planning of the garden cropping scheme, portion of the area may be set apart and only lightly limed, if at all, for certain plants (as indicated below), and the remainder limed for those crops with a higher lime requirement. Potatoes, which will grow on acid soils, do best on slightly acid soils, and in gardens where dry conditions are not experienced the danger from scab diseases in slightly acid soils is small.

The following statement shows the relative sensitiveness of a number of garden and crop plants to acid soil conditions:—

Very Tolerant.—Parsley, potato, radish, strawberry, sweet potato, tomato, cowpea, maize, millet, oats, rye.

Tolerant.—Bean, Brussels sprouts, carrot, choko, cucumber, endive, khol rabi, pea, pumpkin, rhubarb, squash, turnip, watermelon, crimson clover, vetch.

Sensitive.—Broccoli, cabbage, cauliflower, eggplant, sweet corn, barley, rape, red clover, sweet clover, wheat, white clover.

Very Sensitive.—Asparagus, beet, celery, lettuce, onion, parsnip, spinach, lucerne.

Evidence is available to show that excess of lime under certain conditions may depress plant growth. Overliming may result when the calculated amount of lime is applied to the surface zones of soil, and not worked to the proper depth. Overliming injury is produced only on heavily-limed acid soils, and not on non-acid soils, or soils which have previously been limed. This injury is not permanent and is usually overcome by the time the first crop is removed. Lettuce and lucerne are crops which may suffer from bad lime distribution.

Large additions of organic matter such as compost, manure, &c., are very effective in reducing overliming injury, and this fact is of importance in indicating that a liberal addition of green or stable manure should be applied to the soil if immediate liming and seeding are necessary. Where very heavy dressings of lime are necessary, it may be advisable to apply lime in two successive seasonal applications. After the preliminary liming, the lime added in a well-made compost will go far to counteract natural losses of lime from the soil.

Orchard Notes for October.

THE COASTAL DISTRICTS.

OCTOBER is frequently a dry month over the greater part of Queensland, consequently the advice that has been given in the notes for August and September regarding the necessity of thorough cultivation to retain moisure is again emphasised. Unless there is an adequate supply of moisture in the soil to meet the trees' requirements, the coming season's crop will be jeopardised, as the young fruit will fail to set.

Thorough cultivation of all orchards, vineyards, and plantations is therefore imperative if the weather is dry, as the soil must be kept in a state of perfect tilth, and no weeds of any kind must be allowed to grow, as they only act as pumps to draw out the moisture from the soil that is required by the trees or fruit-yielding plants. Should the trees show the slightest sign of the want of moisture, they should be given a thorough irrigation if there is any available means of doing so, as it is unwise to allow any fruit trees to suffer for want of water if there is a possibility of their being supplied. Intermittent growth, resulting from the tree or plant being well supplied with moisture at one time and starved at another, results in serious damage, as the vitality is lessened and the tree or plant is not so well able to ward off disease. A strong, healthy, vigorous tree is frequently able to resist disease, whereas when it has become debilitated through neglect, lack of moisture or plant food, it becomes an easy prey to many pests. If an irrigation is given, see that it is a good one and that the ground is soaked; a mere surface watering is often more or less injurious, as it is apt to encourage a false growth which will not last, and also to bring the feeding roots to the surface, where they are not required, as they only die out with a dry spell and are in the way of cultivation. Irrigation should always be followed by cultivation, so as to prevent surface evaporation and thus retain the moisture in the soil.

All newly planted trees should be carefully attended to, and if they show the slightest sign of scale insects or other pests they should receive attention at once. All growth not necessary to form the future tree should be removed, such as any growths on the main stem or main branches that are not required, as if this is done now it will not only save work later on, but will tend to throw the whole strength of the tree into the production of those limbs that will form the permanent framework of the tree. In older trees all water sprouts or other similar unnecessary growths should be removed.

Keep a good lookout for scales hatching out, and treat them before they have become firmly established and are coated with their protective covering, as they are very easily killed in their early stages, and consequently much weaker sprays can be used. The best remedies to use for young scales hatching out are those that kill the insects by coming in contact with them, such as miscible oils, which can be applied at a strength of 1 part of oil in 40 parts of spraying material, and will do more good than a winter spray of double the strength. In the use of miscible oils or kerosene emulsion, always follow the directions given for the use of those spraying materials, and never apply them to evergreen trees when they are showing signs of distress resulting from a lack of moisture in the soil, as they are then likely to injure the tree, whereas if the tree is in vigorous growth they will do no harm whatever.

All leaf-eating insects should be kept in check by the use of an arsenate of lead spray, taking care to apply it as soon as the damage appears, and not to wait till the crop is ruined. Crops, such as all kinds of cucurbitaceous plants, tomatoes, and potatoes are often seriously injured by these insects, and the loss occasioned thereby can be prevented by spraying in time. In the case of tomatoes and potatoes, a combined spray of Bordeaux or Burgundy mixture and arsenate of lead should be used, as it will serve the dual purpose of destroying leaf-eating insects and of protecting the plants from the attack of Irish blight.

Grape vines require careful attention; and, if not already sprayed with Bordeaux mixture, no time should be lost in applying this material, as the only reliable method of checking such disease as anthracnose or black spot and downy mildew is to protect the wood and foliage from the attack of these diseases by providing a spray covering that will destroy any spores that may come in contact with them. The planting of bananas and pineapples can be continued during the month. See that the land is properly prepared and that good, healthy suckers only are used. Keep the plantations well worked, and allow no weed growth. Keep a very careful

lookout for fruit flies; destroy every mature insect you can, and gather and destroy every fallen fruit. If this is done systematically by all growers early in the season the subsequent crop of flies will be very materially decreased. See that all fruit sent to market during the month is carefully handled, properly graded, and well packed—not topped, but that the sample right through the case or lot is the same as that of the exposed surface.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

MUCH of the matter contained under the heading of "The Coastal Districts" applies equally to these parts of the State; for on the spring treatment that the orchard and vineyard receives the succeeding crop of fruit is very largely dependent. All orchards and vineyards must be kept in a state of perfect tilth, and no weed growth of any kind should be allowed. In the western districts, irrigation should be given whenever necessary, but growers should not depend on irrigation alone, but should combine it with the thorough cultivation of the land so as to form and keep a fine soil mulch that will prevent surface evaporation.

All newly planted trees should be carefully looked after, and only permitted to grow the branches required to form the future tree. All others should be removed as soon as they make their appearance. If there is any sign of woolly aphis, peach aphis, or scale insects, or of any fungus disease on the young trees, these diseases should be dealt with at once by the use of such remedies as black leaf forty, Bordeaux mixture, or a weak oil emulsion. In older trees, similar pests should be systematically fought, as if kept in check at the beginning of the season the crop of fruit will not suffer to any appreciable extent. Where brown rot has been present in previous years, two or more sprayings with Bordeaux mixture can be tried, as they will tend to check other fungus growths, but at the same time the sodium or potassium sulphide sprays are more effectual for this particular disease and should be used in preference when the fruit is nearly full grown. All pear, apple, and quince trees should be sprayed with arsenate of lead—first when the blossom is falling, and at intervals of about three weeks. Spraying for codlin moth is compulsory in the fruit district of Stanthorpe, and wherever pomaceous fruit is grown it must be attended to if this insect is to be kept in check.

In the warmer parts a careful check should be kept for any appearance of the fruit fly, and, should it be found, every effort should be made to trap the mature insect and to gather and destroy any affected fruit. If this is done, there is a good chance of saving the earlier ripening summer fruit, if not the bulk of the crop. Tomato and potato crops will require spraying with Bordeaux mixture, as also will grape vines. Keep a very strict watch on all grape vines, and, if they have not already been treated, don't delay a day in spraying if any sign of an oil spot, the first indication of downy mildew, appears on the top surface of the leaf. Spraying with Bordeaux mixture at once, and following the first spraying up with subsequent sprayings, if necessary, will save the crop, but if this is not done and the season is favourable for the development of the particular fungus causing this disease, growers can rest assured that their grape crop won't take long to harvest.

Where new vineyards have been planted, spraying is also very necessary, as if this is not done the young leaves and growth are apt to be so badly affected that the plant dies.

Farm Notes for October.

FIELD.—With the advent of warmer weather and the consequent increase in the soil temperature, weeds will make great headway if not checked; therefore, our advice for last month holds good with even greater force for the coming month. Earth up any crops which may require it, and keep the soil loose among them. Sow maize, cowpeas, sorghums, millet, panicums, pumpkins, melons, cucumbers, marrows. Plant sweet potatoes, yams, peanuts, arrowroot, turmeric, chicory, and ginger. Coffee plants may be planted out. There are voluminous articles in previous journals giving full instructions how to manage coffee plants from preparing the ground to harvesting the crop, to which our readers are referred.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF JULY, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING JULY, 1934, AND 1933, FOR COMPARISON.

Divisions and Stations.	Average Rainfall. July.	Average Rainfall. No. of Years' Records.	Total Rainfall. July, 1934.	Total Rainfall. July, 1933.
North Coast.	In.		In.	In.
Atherton	1·00	33	1·61	0·94
Cairns	1·56	52	1·25	0·58
Cardwell	1·37	62	1·38	3·18
Cooktown	0·97	58	0·25	0·74
Herberton	0·85	48	1·43	1·12
Ingham	1·52	42	3·16	3·24
Innisfail	4·60	53	5·29	4·08
Mossman Mill	1·23	21	1·71	1·23
Townsville	0·61	63	0·81	1·27
Central Coast.				
Ayr	0·69	47	0·52	2·07
Bowen	0·96	63	0·32	5·19
Charters Towers	0·62	52	0·69	1·53
Mackay	1·72	63	0·59	10·08
Proserpine	1·59	31	1·65	9·29
St. Lawrence	1·39	63	0·68	11·38
South Coast.				
Biggenden	1·34	35	2·13	3·61
Bundaberg	1·80	51	1·45	4·33
Brisbane	2·25	83	5·11	3·24
Caboolture	2·14	47	4·47	4·39
Childers	1·67	39	1·40	3·94
Crohamhurst	2·88	41	6·16	6·39
Esk	1·95	47	3·15	3·14
Gayndah	1·45	63	2·03	3·71
Gympie	2·10	64	2·64	3·60
Kilkivan	1·60	55	2·72	3·03
Maryborough	1·88	63	2·17	3·30
Nambour	2·65	38	4·05	5·10
Nanango	1·64	52	3·26	2·27
Rockhampton	1·77	63	0·42	19·52
Woodford	2·35	47	3·86	4·70
Central Highlands.	In.		In.	In.
Clermont	1·02	63	0·33	6·82
Gindie	1·09	35	..	8·44
Springsure	1·17	65	1·17	9·63
Darling Downs.				
Dalby	1·72	64	2·78	2·57
Emu Vale	1·54	38	3·16	1·97
Hermitage	1·71	28	..	2·19
Jimbour	1·53	46	1·85	2·46
Miles	1·62	49	2·50	3·25
Stanthorpe	2·02	61	3·44	2·41
Toowoomba	2·08	62	3·81	5·53
Warwick	1·82	69	3·44	2·54
Maranoa.				
Roma	1·47	60	1·63	5·04
State Farms, &c.				
Bungeworgorai	1·43	20	1·47	4·61
Gatton College	1·36	35	2·85	2·91
Kairi	1·12	20	0·97	1·05
Mackay Sugar Experiment Station	1·55	37	0·60	9·64

GEORGE G. BOND, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—JULY, 1934.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature. Means. Max.	Means. Min.	Extremes. Max.	Extremes. Date.	Extremes. Min.	Extremes. Date.	Rainfall. Total.	Rainfall. Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·96	79	33	84	28	51	20	25	2
Herberton	..	69	54	76	30, 31	41	8, 20	143	13
Rockhampton	30·11	74	53	81	11	42	7, 8	42	5
Brisbane	30·13	68	52	78	10	42	9	511	9
Darling Downs.									
Dalby	30·16	65	43	75	10	32	20	278	7
Stanthorpe	..	57	37	66	10	23	20, 21	344	10
Toowoomba	..	60	43	71	10	31	20	381	10
Mid-Interior.									
Georgetown	29·99	83	56	91	25	42	6	Nil	..
Longreach	30·11	73	46	81	10	37	6	155	4
Mitchell	30·16	65	40	77	10	28	21	161	5
Western.									
Burketown	30·02	81	57	85	1, 10, 15–18, 24	50	9, 22	Nil	..
Boulia	30·11	70	46	84	9	41	21, 29	148	3
Thargomindah	30·14	64	44	77	15	36	23	59	3

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	September, 1934.		October, 1934.		MOONRISE. Sept. 1934.	MOONRISE. Oct., 1934.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	6·7	5·37	5·33	5·51	12·21	12·50
2	6·6	5·37	5·32	5·52	1·17	1·35
3	6·5	5·38	5·31	5·53	2·9	2·13
4	6·4	5·38	5·29	5·54	2·54	2·45
5	6·3	5·39	5 28	5·55	3·38	3·17
6	6·2	5·39	5·27	5·56	4·14	3·46
7	6·1	5·40	5·26	5·56	4·46	4·15
8	6·0	5·40	5·25	5·57	5·18	4·46
9	5·59	5·41	5·24	5·57	5·46	5·17
10	5·57	5·41	5·23	5·57	6·14	5·31
11	5·56	5·42	5·22	5·58	6·44	6·30
12	5·55	5·42	5·21	5·58	7 13	7·14
13	5·53	5·43	5·20	5·58	7·47	8·6
14	5·52	5·43	5·19	5·59	8·28	9·4
15	5·51	5·44	5·18	5·59	9·15	10·9
16	5·50	5·44	5·17	5·59	10·9	11·13
						p.m.
17	5·49	5·44	5·16	6·0	11·11	12·21
					p.m.	
18	5·48	5·45	5·15	6·0	12·16	1 28
19	5·46	5·45	5·14	6·1	1·23	2·32
20	5·45	5·46	5·12	6·2	2·33	3·38
21	5·44	5·46	5·11	6·2	3·42	4·38
22	5·43	5·47	5·10	6·3	4·47	5·40
23	5·42	5·47	5·9	6·3	5·52	6·46
24	5·41	5·47	5·8	6·4	6·59	7·52
25	5·40	5·48	5·7	6·5	8·3	8·59
26	5·39	5·48	5·6	6·6	9·6	9·48
27	5·37	5·49	5·6	6·6	10·8	10·42
28	5·36	5·49	5·5	6·7	11·6	11·28
29	5·35	5·50	5.4	6.7	12·0	a.m.
30	5·34	5 50	5·4	6·8	..	12·10
31			5·3	6·9	..	12·45

Phases of the Moon, Occultations, &c.

1 Sept.	☽	Last Quarter	5 40 a.m.
9 ,,	●	New Moon	10 20 a.m.
16 ,,	☾	First Quarter	10 26 p.m.
23 ,,	○	Full Moon	2 19 p.m.
30 ,,		Last Quarter	10 29 p.m.

Apogee, 5th September, at 4.6 p.m.
Perigee, 21st September, at 11.6 a.m.

At 5 p.m. on the 12th the crescent Moon will be passing from west to east of Jupiter, which will be at a distance of 7 degrees to the north of it. The Moon and Jupiter will be high up in the north-west, coming into view an hour later.

An occultation of Antares will occur on 15th September, which will be more noticeable in the far west of Queensland than on the eastern coast, where the Moon and star will be on or near the western horizon, setting a little before midnight.

When Jupiter sets at 7.30 p.m. on the 29th the rapidly moving planet Mercury will follow it about 6 minutes later. The nearness of the two planets to one another will be noticeable half an hour or more before they disappear, the Sun having set at 5.50.

An interesting spectacle for observers with a telescope would have been afforded about a quarter past 5 a.m. for several mornings, especially on the 21st, by the apparent nearness of Venus and Neptune, then being only half a degree apart (a distance equal to the width of the Moon), if it had not been for the increasing daylight, sunrise being at 5.44.

Mercury sets 23 minutes after the Sun on the 1st; on the 15th it sets at 6.53 p.m., one hour after the Sun.

Venus rises at 5.7 a.m. on the 1st, and at 5.6 a.m. on the 15th.

Mars rises at 4.8 a.m. on the 1st and at 3.46 a.m. on the 15th.

Jupiter sets at 8.46 p.m. on the 1st and at 8.13 p.m. on the 15th.

Saturn rises at 4.25 p.m. and sets at 5.37 a.m. on the 1st; on the 15th it rises at 3.11 p.m. and sets at 4.38 a.m.

When the Southern Cross comes into view soon after sunset on the 1st, it will be noticeably curving downwards towards its greatest western elongation, indicated by III. on the clockface, which it will reach at 8 p.m. if the observer is near the 150th meridian. It will then be 30 degrees from the South Celestial Pole, after which it will continue to curve downwards till 2 a.m., when it will reach position VI. and be due south. In this position it becomes lost in Queensland, not reappearing till the following evening, when the positions mentioned will be reached 4 minutes earlier.

9 Oct.,	●	New Moon	1 5 a.m.
16 ,,	☾	First Quarter	5 29 a.m.
23 ,,	○	Full Moon	1 1 a.m.
30 ,,	☽	Last Quarter	6 22 p.m.

Apogee, 3rd October, at 7.54 a.m.
Perigee, 19th October, at 12.18 a.m.
Apogee, 31st October, at 3.24 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

ANNUAL RATES OF SUBSCRIPTION.

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QUEENSLAND AGRICULTURAL JOURNAL

VOL XLII. 1 OCTOBER, 1934. PART 4.

Event and Comment.

Fruit-Fly Control.

AS a consequence of resolutions passed by the mass meeting of fruit-growers at Stanthorpe on Wednesday, the 26th September, the Minister for Agriculture and Stock (Hon. Frank W. Bulcock), who attended the meeting, has announced that instructions have been issued to fruit inspectors in the Stanthorpe district to enforce rigidly the new regulations for the control of fruit fly during the coming season. The new measures will apply to the Stanthorpe, Warwick, and Killarney districts. Six additional inspectors will patrol these districts during the next five months, and action will be taken against those persons, including householders with fruit trees growing in their back yards, who neglect to carry out the requirements of the Department in respect of fruit fly control. For the information of householders, Mr. Bulcock added that the term "orchard" was defined by the Diseases in Plants Act as "any place where one or more fruit-producing plants are growing."

The new regulations provide—

(*a*) That fruit-fly traps charged with lure must be forthwith placed in every orchard in the districts concerned at the rate of one trap per acre, or part thereof.

(*b*) In the case of cherries and other early fruits, traps at the rate of ten per acre must be placed in the trees immediately.

(*c*) In the case of all fruits maturing before the 1st January, 1935, traps must be placed in position by the 15th November next at the rate of ten traps per acre.

(*d*) In the case of all fruits maturing before the 1st February, 1935, traps at the rate of ten per acre must be placed in position by the 15th December, 1934.

(*e*) In the case of fruits maturing after the 1st February, 1935, traps at the rate of ten per acre must be in position by the 1st January.

The traps must be cleaned out and charged with fresh lure twice per week.

It is to be hoped, added the Minister, that in this special effort to control fruit fly in our main deciduous fruit-growing areas, all persons who have fruit trees growing will co-operate with the Department in the carrying out, both in the spirit and letter, of these regulations.

A Story of Remarkable Development.

A STORY of remarkable development and prosperity in North Queensland was told by the Deputy Premier (Hon. P. Pease) on his return from a recent visit that took him as far as Cooktown. "From Mackay northwards there has been immense development in agriculture, and on all sides I saw unmistakable signs of progress and confidence," he said.

He had noticed that a transition period in the history of North Queensland was taking place. For many years the settlers north of Mackay had been loath to engage in anything but sugar farming. They naturally thought a cane crop that yielded from £40 to £50 an acre was more attractive than a yield of £10 an acre from a mixed farm. That reasoning had held good while the sugar industry was in its infancy, but the industry had now reached a stage when the growers produced more than Australia required, and they were obliged to sell the surplus overseas at a price much below the cost of production.

The North had been forced to turn to other avenues of agriculture in the enormous area that remained uncultivated, and this had led to quick development. From the Rise and Shine, O'Connell River, and Eungella lands, in the Mackay district, to the rich lands that lay in the hinterland of Cooktown, there were manifold signs of this more intensive cultivation. Not only was the land being tilled, but there was a ready home market for the produce that it yielded.

For instance, North Queensland for many years had been one of the most prolific fields for the vendors of powdered and condensed milk, which now had been almost wholly replaced by fresh milk from district dairies. Practically the whole of the milk consumed at Mount Isa now was sent under contract by an Ingham dairyman, who dispatched it in pasteurised form in bottles. The same dairyman had orders for three times as much milk as he could supply, and the demand came from places as far distant as New Guinea.

"What is doing more than anything else to settle North Queensland more closely is the provision of more main roads," said Mr. Pease. Despite the abnormally wet season in the North, a fine network of roads was being built to connect lands that were being thrown open to settlers, and when the planned roads were built Queensland would possess one of the longest and best road systems in the world. He could not help

noticing the effect of this improved means of communication in one particular instance—the growth of Mossman, where buildings were being erected, the population had increased, and people on the farm lands were finding an excellent market for their produce in Cairns.

The best proof of development in the North was that in every centre his party visited a deputation had asked for schools in areas where none existed previously. Places which a few years ago were covered by untrodden jungle were now neat, well-developed communities, and this was particularly true of the stretch of land from Townsville to Cooktown.

Although the tobacco industry was not in the most prosperous condition, it had great possibilities, and needed only reorganisation and some adequate form of protection. At the recent sales at Mareeba aromatic leaf brought upwards of 4s. per lb., indicating that a demand for it existed.

"The Government," added Mr. Pease, "was bent on making the most of Northern development. The greater part of the undeveloped Crown lands was situated in that quarter of the State, and offered wonderful scope for adding to Queensland's natural wealth."

Lure of the City.

COMMENTING on the lure of the city, the Public Service Commissioner, Mr. J. D. Story, I.S.O., said in the course of his annual report: "Clearly, it is not possible at present to absorb into vocations peculiar to the towns all those lads who desire employment in such vocations. The growth in the number of applicants who desire employment in clerical and allied positions, and particularly in the various State services, is disconcerting. One views with dread each year the results of the public examinations. Those examinations open the flood-gates and the applications pour in. Parliamentarians, as well as officials, are caught in the vortex. Ten State Service vacancies for male clerks were declared in connection with last Junior examination. There were 580 applicants, and 497 obtained 50 per cent. of marks or over. Ten vacancies were declared for clerk-typists; there were 222 entries, and 201 of the applicants obtained 50 per cent. of marks or over. Approximately 250 senior certificate holders are registered for employment, and there are, in all, not less than 2,000 applicants for employment in the section of the State Service under my jurisdiction. These facts demonstrate the great seriousness of the position.

"The concern is still further intensified by the disinclination of many boys to proceed to positions in the country and the reluctance of their parents to permit them to leave home. The allure of the city grows magically. Entertainers vie with entertainers in providing super attractions. The artificial pleasures of the town are not found in the country; and the routine life of the farm, with its round of chores and ups and downs, lacks the attraction of a great adventure. Cream is not associated with doubloons, nor milk with pieces of eight. Yet the merino fleece, if not the pig, helps to pay the Australian rent.

"The towns depend largely upon the country. If the country stagnates the stagnation will react upon the cities, and the cities will perforce be compelled in their own interests to find ways and means of balancing, in kind, conditions as between city and country. And, the city allure notwithstanding, there are many compensating advantages in the country."

Spraying Experiments for the Control of Fruit Fly in the Stanthorpe District.

By HUBERT JARVIS, Entomologist.

IT is generally recognised that repellents have not yet played an important part in the control of insect pests. This may in some measure be due to a very meagre knowledge of the senses of insects and to the assumption that an odour repellent to a human being would also be repellent to an insect, whereas the reverse might be the case. Furthermore, an odour hardly discernible to man might have considerable value as a repellent or an attractant to the insect community.

Recently serious study has been given by entomologists to this possible avenue of control, and some considerable measure of success has been achieved in South Africa by Dr. Ripley and Mr. Hepburn, who have tested some 350 compounds—essential oils and other substances—for attractant, obscurant, and repellent values in relation to the Natal fruit fly, *Ceratitis rosa* Ksh., which is a serious pest of citrus and other fruits in that country.

During the last few years some time has been devoted in the Stanthorpe district to the study of the possible value of various odours and sprays as a supplementary measure in controlling the Queensland fruit fly *Chætodacus tryoni* Frogg., and during the 1932-33 season it was noticed that the fruit on trees sprayed experimentally with a nicotine sulphate-white oil spray for the control of codling moth was free from fruit fly attack. This spray was accordingly tested as a possible fruit fly repellent during the season just concluded, and the information obtained in the course of the experiment is embodied in this report.

DETAILS OF THE EXPERIMENT.

The plot selected for the work was situated at Severnlea, and comprised two rows of Granny Smith apple trees, there being twenty-eight trees to the row, the sprayed trees being separated by an intermediate row in which the trees were mostly an earlier-maturing variety from which the fruit had already been harvested. The intermediate row was, therefore, not included in the experiment. Twelve trees were left untreated at one end of the plot and four at the other end, thus giving sixteen untreated trees, as controls, and forty sprayed trees. The majority of the trees were very vigorous and full of leafage, and carried a good crop of fruit.

The sprayed trees were given four treatments at approximately weekly intervals (Table I.) with the nicotine sulphate-white oil spray, which was used at a strength of half a pint of nicotine sulphate and half a gallon of white spraying oil to forty gallons of water.

TABLE I.

Time and Cost of Application of Sprays.

Date of Application.	Number of Trees Sprayed.	Materials Used and Strength.	Quantity Spray Fluid in Gallons.	Cost per Application.	Total Cost.	Cost per Tree.
				s. d.	£ s. d.	d.
7th February	40	Nicotine sulphate 1-640 with white oil 1-80	40	6 4½	1 5 6	7·65
12th ,,	40		40	6 4½		
19th ,,	40		40	6 4½		
28th ,,	40		40	6 4½		

The spray was applied with a power plant at a pressure of from 250 to 300 lb., each tree receiving about a gallon of spray fluid per application.

The weather throughout the experiment was favourable for fruit-fly activity, being warm and sultry. Although two of the sprays were applied during fairly hot weather conditions, no damage to the fruit or foliage was observed.

As the fly was active and had caused some loss to the Jonathan apple crop, it was decided to pick the main crop from the control trees, in order to avoid unnecessary loss, and at the time of the first application approximately six cases of fruit remained on the control trees.

Results Obtained.

A week after the first application a few fly-stung apples were found on the control trees, and by the second week over a hundred infested apples were counted. The sprayed trees were also frequently examined, but no fly-stung fruit was found on them until the time of picking the crop, when only thirty-seven fly-stung apples were found in 171 cases graded. The apples were stored in cases in the shed for three weeks, and a final count was made for fruit-fly infestation, the total number of fly-stung fruit from the sprayed trees being 154 apples (Table II.).

TABLE II.

Results of Fruit-Fly Spraying Experiment.

	Total Number of Apples.	Sound.	% Sound.	Unsound.	% Unsound.	Fruit fly-infested.
Treated Trees	17,100	16,946	99·1	154	0·9	154
Untreated Trees ..	607	146	24·1	461	75·9	461

Discussion of Results.

The results obtained indicate that nicotine sulphate and white oil was of definite value in this particular experiment in protecting the apples from fruit-fly attack, the fruit on the sprayed trees being practically 100 per cent. clean, whereas the fruit on the control trees was 75·9 per cent. fly-infested.

In the centre of the intermediate row separating the two experimental rows there were two trees—one Jonathan and one Granny Smith—which carried a considerable quantity of fruit during the course of the experiment, and which were, of course, unsprayed. The Jonathan tree, from which the main crop had been gathered, still carried eighty-one apples, of which number seventy-five were fly-stung—i.e., 92·6 per cent. The Granny Smith tree carried 126 apples, seventy of which were clean and fifty-six fly-stung—i.e., 44·4 per cent. were attacked.

It will thus be seen that the fly was active right in the middle of the plot, and it seems only reasonable to conclude that the spray used acted as a repellent to the fly, as the treated trees were loaded with fruit and only a few feet away from the untreated trees. This conclusion is, moreover, supported by minor experiments conducted with this spray in the Broadwater district.

It is necessary to remind readers that this is merely a preliminary experiment, and that it will obviously be desirable to carry out further trials next season—not only on apples, but also on other fruits—to test the efficiency of the spray and the degree of safety of application. Furthermore, it will be necessary to determine whether there are any cumulative ill-effects arising out of repeated applications of oil sprays on deciduous fruit trees.

ACKNOWLEDGMENTS.

Thanks are due to Mr. E. Cran, who made available the trees for the work, and whose co-operation throughout the experiment was of the greatest assistance. Thanks are also due to the Chief Entomologist, Mr. Robert Veitch, for making possible the work and for his valuable advice and assistance.

A FARMER'S APPRECIATION OF THE JOURNAL.

A Yarwun farmer writes (21*st July*, 1934):—"*I wish to congratulate you most heartily on the excellence of your Journal, for I appreciate to the full the great value it is to the primary producer, almost every phase of farming, fruit culture, and stock-raising being dealt with in simple language, without a lot of unnecessary rigmarole scientific terms, which very often confuse the ordinary producer like myself. Your article in the current month's issue on bread-making in the farm kitchen was, in the wife's opinion, splendid, and despite her forty years' experience of bread-making she found out points that were to her previously unknown.*"

Parasites of the Horse.

By F. H. S. ROBERTS, M.Sc., Entomologist, Animal Health Station, Yeerongpilly.

EXTERNAL PARASITES.

THREE species of lice and three species of mites are known to infest the horse, the latter being concerned with mange conditions.

LICE.

Description and Life History.

Of the three species of lice usually found on horses, one species, *Haematopinus asini,* is a sucking louse, the two other species, *Trichodectes pilosus* and *Trichodectes equi,* being biting lice.

The sucking louse (Plate 195, A and B) is yellowish in colour with a brownish thorax and measures about one-eighth of an inch in length. The head is long and narrow, terminating in a blunt point. The eggs laid by the female louse are attached to the hairs and hatch in twelve to fourteen days. The young louse becomes mature and may lay eggs when eleven to twelve days old.

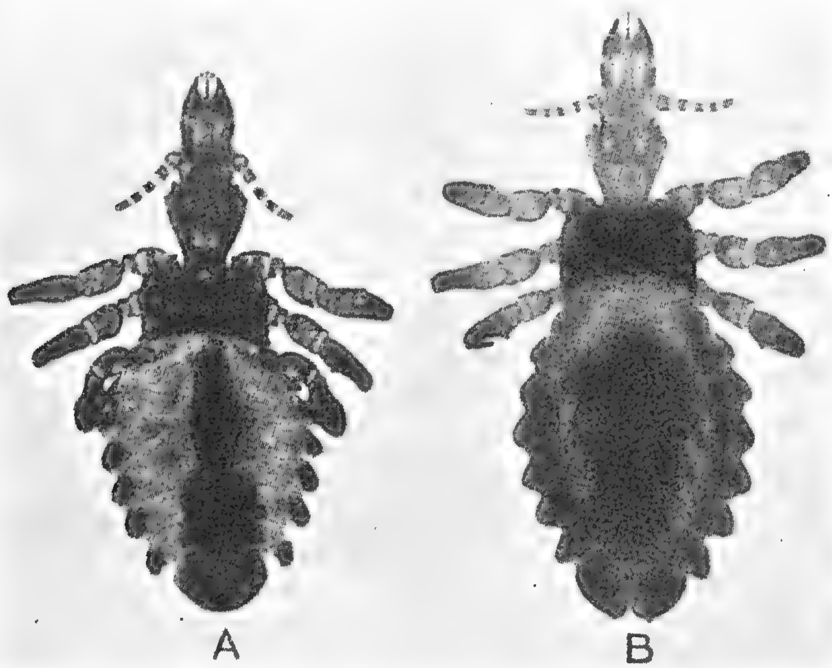

PLATE 195.—SUCKING LOUSE OF THE HORSE (*Hæmatopinus asini*).
A—Male. B—Female.
(Magnified 25 times.)
(From Circular 148, United States Department of Agriculture.)

The two species of biting lice are very similar in appearance, the head being slightly longer than broad and semi-circular in front. *T. pilosus* (Plate 196, A and B) is larger than *T. equi,* with the antennæ placed well back from the anterior margin of the head, whereas in *T. equi* the antennæ are almost on a line with the anterior border.

The general colour of the abdomen in both species is yellow and that of the head, thorax, and legs brownish. The life histories are very similar, the eggs hatching in eight to ten days.

Horses infested with lice may manifest uneasiness and irritation and scratch, rub, and bite the affected portions of the body. Lice most usually occur on the back, flanks, jaws, and butt of the tail, but in heavy infestations the whole body may be involved.

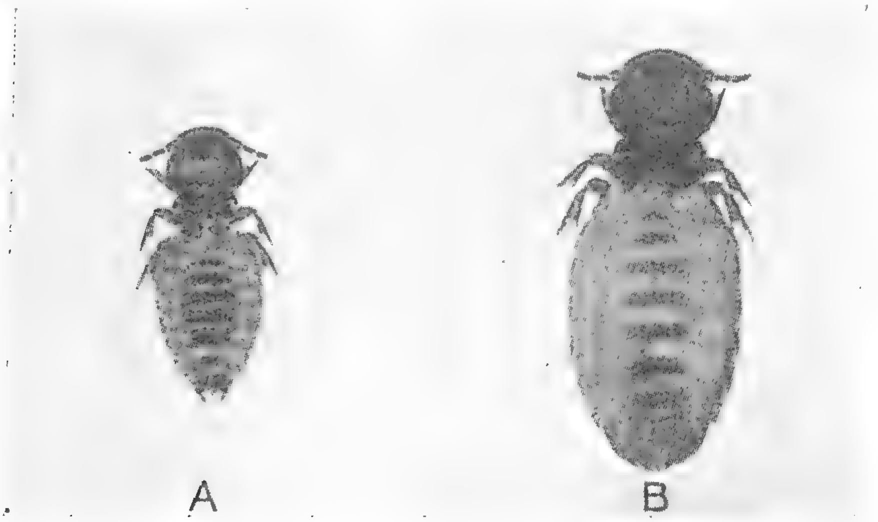

PLATE 196.—BITING LOUSE OF THE HORSE (*Trichodectes pilosus*).
A—Male. B—Female.
(Magnified 25 times.)
(From Circular 148, United States Department of Agriculture.)

Treatment and Control.

Good results follow dipping or spraying in an arsenic dip, two treatments with an interval of fourteen to sixteen days being required. If the infestation is of no great extent the dip solution may be applied as a wash.

Lice are spread mainly by contact. The sucking louse, however, may remain alive off the horse two to three days and the biting lice as long as ten days. Moreover, the eggs may retain their vitality for twenty days when removed from the horse and the young lice that hatch may live a further two to three days. Premises may, therefore, remain infected for twenty-five to thirty days after infested animals have been removed. The stables should, therefore, be thoroughly cleaned out and disinfected. Harness, blankets, curry combs, &c., used on infested horses should be similarly treated.

MANGE.

The three species of mange mites infesting the horse are each concerned with a mange condition which is designated from the generic name of the mite associated with it. Thus we have Sarcoptic, Psoroptic, and Chorioptic mange. Sarcoptic mange is unknown in Queensland and Psoroptic and Chorioptic mange are by no means common.

Sarcoptic Mange.

The mites which cause Sarcoptic mange are known as *Sarcoptes scabiei equi*. These parasites are very minute in size measuring no more

than one-fiftieth of an inch in length. They have a rounded body and four pairs of short thick legs and live in galleries under the skin.

Symptoms of Sarcoptic Mange.

The mites in burrowing under the skin cause great irritation and itching and the skin becomes inflamed and swollen. In time scales and crusts are formed over the affected area and the hair falls out. The animal's biting and scratching at the irritation causes the formation of large thick scabs with which is mingled blood and serum from the broken skin. Eventually the skin becomes thickened and thrown into conspicuous folds.

Usually the head, neck, and shoulders are first attacked, but occasionally the disease may commence on other parts of the body and if unchecked will ultimately affect the whole trunk.

Psoroptic Mange.

This condition is caused by a species of mite, *Psoroptes communis equi.* These mites live on the skin surface, puncturing it with their mouthparts to obtain blood and serum on which they live.

Symptoms of Psoroptic Mange.

Psoroptic mange usually appears first on the head under the forelock, round the roots of the mane and on the rump. The itching and irritation caused by the mites produces inflammation and the formation of papules. Serum exudes from the affected skin and large yellowish crusts are formed. As the disease advances the whole body may become affected and the skin is thickened, toughened and thrown into folds.

Chorioptic Mange.

This disease which is caused by the mite, *Chorioptes equi,* is usually confined to the foot and fetlock. The mite lives on the skin surface and produces a condition somewhat similar to that described for Psoroptic mange. The irritation resulting from infestation causes the horse to stamp and kick, and bite and rub the affected parts.

Treatment and Control of Mange.

For ordinary infestations successful treatments are available and of these dipping, spraying, or washing the affected areas with lime sulphur will be found satisfactory. For sarcoptic mange, treatment should be repeated every five to seven days until a cure is effected. For psoroptic and chorioptic mange the intervals between treatments should be increased to ten days.

To make an efficient lime sulphur solution take 1 lb. of slaked lime and 1½ lb. flowers of sulphur. Add sufficient water to the lime to make a thin paste, then sift in the sulphur stirring and, if necessary, adding water till a mixture of the consistency of mortar is secured. Pour into this mixture about 2 gallons of boiling water and boil until the sulphur disappears from the surface, keeping the mixture well stirred. When the mixture becomes a dark amber or chocolate in colour (about two to three hours) the boiling should be discontinued and the contents allowed to stand till clear. Pour off the clear liquid to which is added sufficient warm water to make 6 gallons. Before using, 7 parts of warm water should be added to every 3 of the prepared concentrate.

Hand applications of crude oil are also recommended as a treatment for mange. Horses so treated should be kept in the shade, as otherwise the oily dressing may blister the skin.

As mange is spread chiefly by contact all affected horses should be isolated till cured. There is also a risk that animals may pick up an infection from stables, &c., in which infested horses have been stalled. Such stables and any harness, curry combs, blankets, &c., should therefore be thoroughly cleansed and disinfected.

INTERNAL PARASITES.

Very few, if any, horses are entirely free from internal parasites, which, with the exception of the bots, are all helminths or worms.

Internal parasites are particularly damaging to young animals, attacking them at a period when they should be making their best growth and rendering them stunted and unthrifty. Among older animals parasite presence is shown by bigger feed bills and the inability of the infested animals to carry out their normal day's work. Stunted growth, emaciation, rough coat, anæmia, swollen abdomen, and sometimes colic and diarrhœa may be associated with an infestation and not infrequently death may follow.

The more important of these parasites are found in the alimentary canal and fortunately most of them are amenable to treatment. Their eggs are present in the manure so sanitation and proper disposal of this infected material is of the utmost importance for parasite control.

BOTFLIES AND BOTS.

There are three species of botflies known to attack the horse, the common botfly, *Gastrophilus intestinalis,* the throat botfly, *Gastrophilus nasalis,* and the nose botfly, *Gastrophilus haemorrhoidalis.*

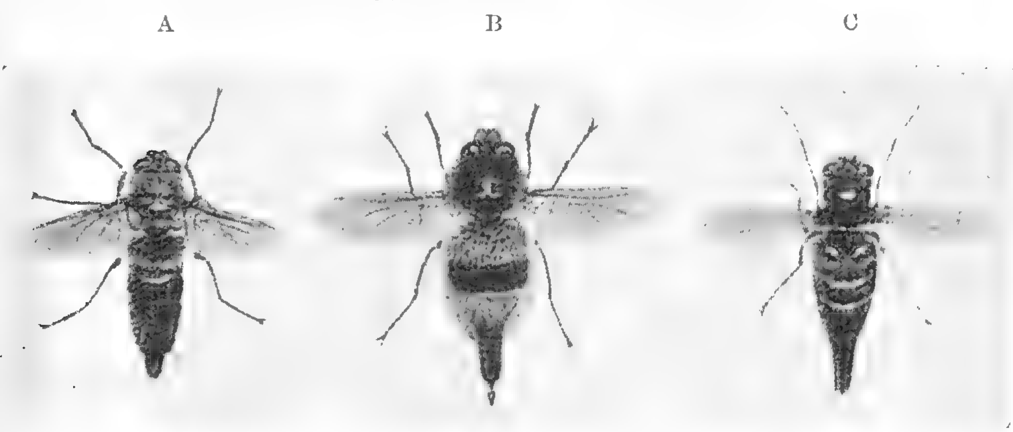

Plate 197.—Adult Botflies.

A—The Common Botfly. B—The Throat Botfly. C—The Nose Botfly.

(After Hadwen and Cameron.)

The adults are all two-winged insects, bee-like in appearance, each species differing somewhat in colour markings, size, and habits. The common botfly (Plate 197 (C)) is a brownish-grey species with mottled wings and a white face. The female deposits her eggs on the hairs of the mane, chest, shoulders, and legs, most usually on the long hairs of the forelegs, inside and below the knee. During egg-laying the female hovers around the animal, curving the abdomen beneath the

body in order to facilitate the deposition of the eggs, each of which is laid and fastened to the hair in about a second. The position of the abdomen at the time of egg-laying has given the impression that the fly stings the horse, but this is erroneous.

The throat botfly (Plate 197 (B)) is somewhat smaller than the common botfly and has a reddish thorax and a prominent black band across the abdomen. The wings are clear. The eggs are deposited by the female on the hairs under the jaws. The female fly is usually seen hovering near or between the forelegs of the horse and then quickly darting at the throat to lay her eggs. One to four eggs may be laid at the one time, each attached singly to the hairs. The presence of this fly causes the animal to nod its head violently and sometimes to strike with the forelegs.

The nose botfly (Plate 197 (A)) is the smallest of the species under discussion, and chooses the hairs of the lips for egg-laying, particularly those hairs on the edge of the lip which are moistened by the saliva. The flight of the fly is very rapid, the insect darting at the lips to deposit a single egg and then withdrawing for a few seconds to repeat the process.

Of these three species, the throat botfly is most frequently seen in Queensland. The common botfly is not uncommon but the nose botfly is regarded as being rare, if present at all.

As the mouth parts of the adult flies are rudimentary they cannot feed and are therefore comparatively short-lived. The common botfly has been known to live as long as twenty-one days, but the average life is not thought to extend much beyond a week. The two other species live only about three to twelve days, the throat botfly surviving the longer period.

LIFE HISTORY NOTES.

The Egg.

The eggs of these three botflies are glued to the hairs of the horse and differ considerably in shape, colour, and manner of attachment. The egg of the common botfly is yellowish in colour and is attached to the hair for about one-third of its length, the free portion of the egg forming an angle with the hair. Frequently more than one egg may be attached to a single hair, especially if the hair is long. The eggs do not hatch until they are rubbed or licked by the horse. The minute, spiny maggots are ready to hatch in about seven days, though they may remain unhatched and alive for months.

The eggs of the throat botfly are slightly different in shape to those of the common botfly and are fastened to the hair for about two-thirds of their length. These eggs do not require friction to cause hatching, which takes place normally.

The eggs of the nose botfly are black and stalked, the stalk being corkscrew-like and continued to the follicle from which the hair arises. Here, again, hatching does not require friction; the eggs nearest the moist edges of the lips hatch first, usually in five to six days, while those an inch away may take as long as eighteen days, and those some distance from the lips may not hatch at all.

The Larva or "Bot."

On hatching, the larvae of all species enter the mouth. In the case of the common botfly, of which the life history is best known, the larvae

then bore their way beneath the lining of the mouth and tongue, where they remain for some time. Eventually the larvæ of all three species make their way to the stomach.

Once in the stomach, the larvae attach themselves to the wall by means of a pair of strong mouth hooks (Plate 197). The common bots are reddish in colour and are found attached to the white covering of the left sac and along the ridge between the right and left sacs. The larvae of the throat botfly occur most usually near the pyloric or

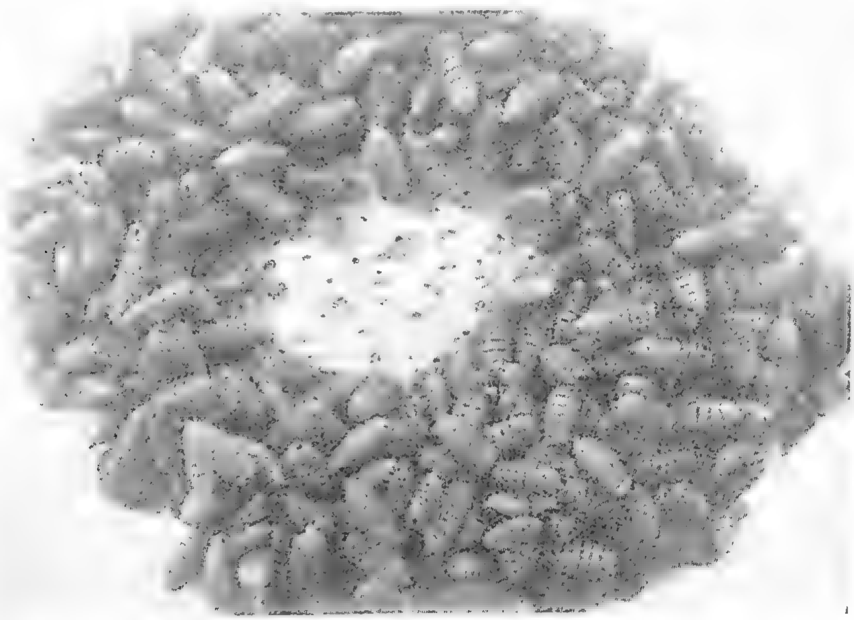

PLATE 198.—"BOTS" ATTACHED TO THE STOMACH WALL, SHOWING LESIONS IN THE CENTRE.
(From Bulletin 957, United States Department of Agriculture.)

exit end of the stomach, and in that portion of the intestine leading out of it. Those of the nose botfly may occur attached to various parts of the stomach, but are more usually located near the pyloric end. The larvae or "bots" are all provided with rows of spines on the anterior border of the majority of the segments, the number and arrangement of the spines differing in each species. After living in the stomach for about eight to twelve months the larvae are fully grown and are passed out with the dung. Those of the common botfly and throat botfly pass out without any reattachment; but in the case of the nose botfly the larvæ fasten themselves to the rectum and again to the anus before they finally reach the ground.

The Pupa.

As soon as they reach the ground the larvæ at once commence to seek some protection. However, they do not crawl very far, and burrow into the soil only a short distance. In one to four days the outer skin hardens and forms a protective coat, known as the puparium, inside which the transformation from the larva or "bot" to the adult fly takes place. The puparium is brown to black in colour, but is otherwise similar to the bot. At the end of about three to ten weeks the transformation is complete, and the adult fly emerges.

Injuries Caused by Botflies.

Possibly the greatest damage among horses through botfly presence is self-inflicted. Extreme annoyance and worry is caused during egg-laying by the females, as the horse recognises its enemy and makes desperate efforts to protect itself. The common botfly appears the least irritating of the three species, probably because of the varied situations in which its eggs are deposited. Even so its presence keeps the animals in a continuous state of annoyance and prevents them from resting. The throat botfly causes the animal to throw its head about violently, and makes it difficult to manage in harness. The nose botfly appears to be the most annoying species, for the insect, in depositing its eggs on the hairs of the lips, causes a severely irritating tickling. The actions of horses while the insects are about are very characteristic. The throat botfly causes them to stand together with their heads over each other's back, and if the nose fly is about they protect their lips by placing them against each other's body. Should the insects be numerous, and the protections abovementioned be inadequate, the animals keep up a continuous movement, occasionally breaking into a gallop, in attempts to prevent the insects alighting and laying eggs.

It is commonly considered that the bots in the stomach are of little importance. It should be remembered, however, that the larvæ are developing for eight to twelve months in the horse's stomach, and during this period considerable harm may be done. The spiny armature and the large mouth hooks cause inflammation of those parts with which they may come into contact, which results in an interference with digestion. Very commonly many hundreds of bots may bring about obstructions and seriously interfere with the passage of food. The nature of the food taken in by bots is not known, but they certainly live at the expense of the horse, and the pinkish hue of some of the larvæ indicates that they may be blood suckers. It has also been shown that their body fluid is decidedly toxic, and if a small quantity of this fluid is injected beneath the skin alarming symptoms may result.

Protection and Treatment.

Various devices have been recommended for the protection of the horse against botfly attack. For the throat botfly a piece of ordinary

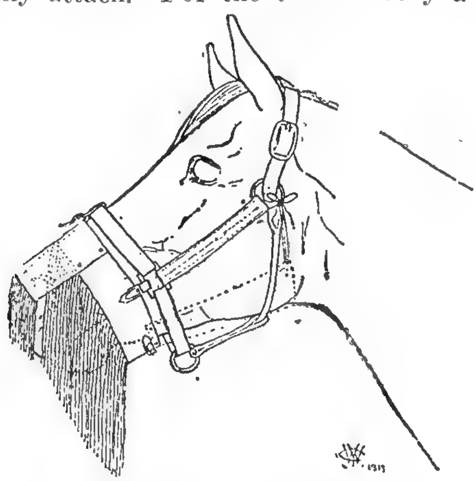

Plate 199.—Leather Nose-fringe as Protection against the Nose Botfly (after Hadwen and Cameron).

canvas attached to the nose band and tied to the headstall will completely cover the region between the jaws. As protection against the nose botfly the Canadian authorities recommend a leather band cut into thin strips and encircling the nose (Plate 199). In the United States excellent results have followed the use of a mouth guard constructed from $\frac{1}{2}$-inch hardwood boards. For protection against the throat and nose flies it is recommended that the throat be covered by a piece of canvas which is attached in front to the wooden mouth protector (Plate 200). Furthermore, this combination device is said to prevent the animal from taking into the mouth the larvæ of the common botfly while attempting to bite or scratch itself. The hardwood guard completely protects the lips when the head is up, and the block beneath causes the guard to fall back when the head is lowered, and does not interfere in any way with the animal's grazing.

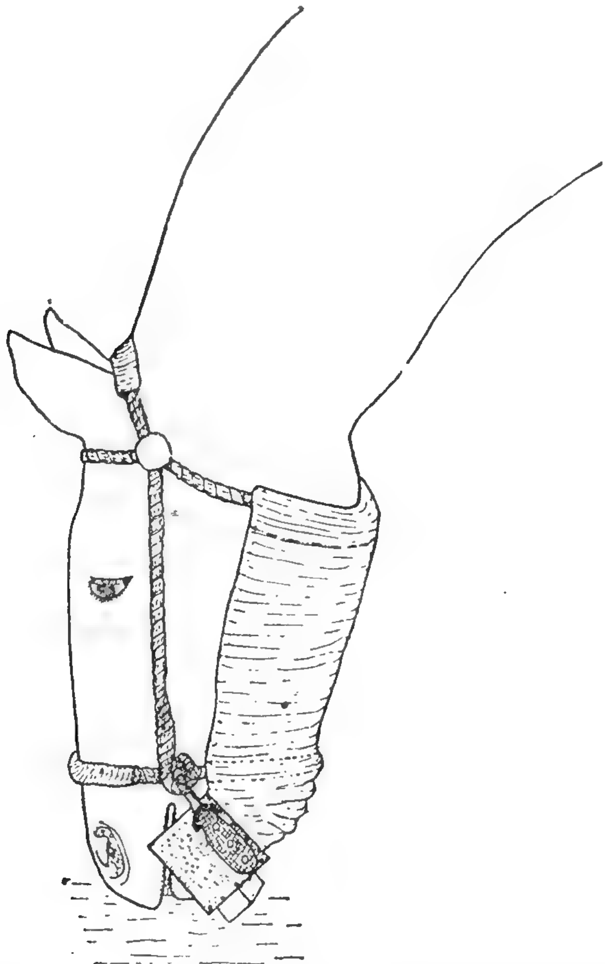

Plate 200.—Device for Protection against the Throat and Nose Botflies (after Bishopp and Dove).

Another effective protector for use against the nose botfly when the horse is in harness consists of a piece of leather 4 to 6 inches wide attached at each side to the bit ring so that the entire lips are covered.

As the eggs of the common bot are not confined to any particular region of the horse, it is difficult to recommend any good means of protection. The mouth guard mentioned (Plate 200) will be found beneficial. In other parts of the world the provision of deep sheds or brush shelters is said to give some protection, for when the flies are bad the animals may retire into the sheds, into the shady interior of which the flies will not venture.

Frequent grooming and clipping of the hairs of the areas on which eggs are laid will aid in control, and a 2 per cent. carbolic wash applied with a rag will kill the majority of the eggs.

For the removal of the bots carbon bisulphide will be found very efficient. The animal should be fasted for eighteen to twenty-four hours before treatment, and the drug is given in a capsule, the dose rate being 6 cubic centimetres for every 250 lb. weight, horses of 1,000 lb. weight or more therefore requiring a dose of 24 cubic centimetres. The capsule may be administered either by hand or with a balling gun. No food or water should be given for three hours after treatment. No purgative is required either with or following the drug. If there is any question as to the animal's ability to tolerate this dose, divided doses may be given and treatment suspended if ill-effect follows the administration of a partial treatment. Great care should be taken in the administration of the capsule, for if it should break and the drug enter the lungs fatal results may follow.

It is also advisable to wash the animal thoroughly with the 2 per cent. carbolic solution before treatment to destroy any eggs, otherwise the young bots hatching from the eggs will be taken in and reinfest the stomach.

TAPEWORMS (Anoplocephala spp.).

Three species of tapeworms are known to infest the horse, the largest and smallest of which, *Anoplocephala magna* (Plate 201) and *Anoplocephala mammillana* respectively, are found in the small intestine. The third species, *Anoplocephala perfoliata*, occurs in the large intestine, particularly in the blind gut or cæcum.

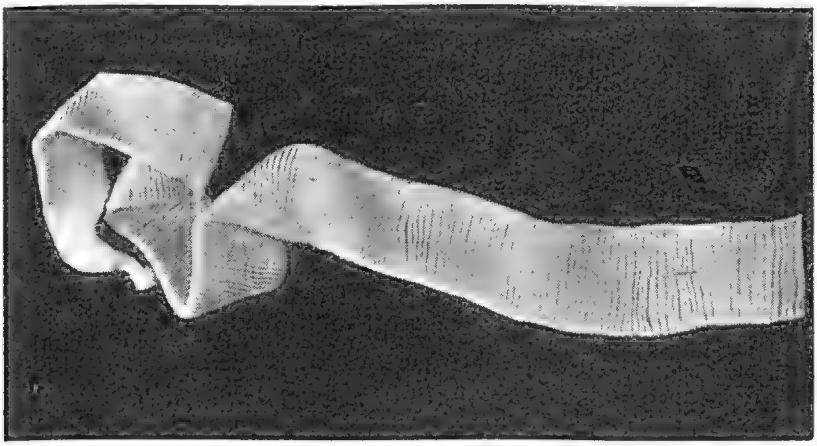

Plate 201.—The Large Tapeworm of the Horse (*Anoplocephala magna*). (Natural size.)

Unless present in large numbers tapeworms do not appear to cause any serious ill-effects, but a heavy infestation might cause emaciation

and anæmia. *A. perfoliata* is the most harmful species, and produces ulcer-like lesions on the intestine wall. Their life histories are unknown.

Tapeworm infestation may be readily diagnosed by examining the fæces in which segments of the worms may be found. Blood-stained fæces is often indicative of the presence of *A. perfoliata*.

Treatment and Control.

Turpentine is said to be satisfactory if given in a dose of 2 fluid ounces in capsules after thirty-six hours starvation, followed every second day by 1 ounce in capsule until five or six doses have been given. The last dose should be preceded or followed by 1½ pints of raw linseed oil. This treatment is for a 1,000-lb. horse, and the dosages should be reduced accordingly for lighter and younger animals.

Tartar emetic is also considered effective in two doses of 3 drachms each at an interval of twelve hours. The drug should be mixed with a gruel of linseed meal.

As the life histories of the horse tapeworms are unknown, general control measures only can be recommended, and of these sanitation is the most important.

THE LARGE STOMACH WORMS (Habronema spp.).

Three species of large stomach worms, *Habronema spp.*, occur in the stomach—namely, *H. megastoma, H. muscæ,* and *H. microstoma*. Both *H. muscæ* and *H. microstoma* may grow up to an inch in length, and occur free or attached to the stomach wall. *H. megastoma,* on the other hand, rarely exceeds half an inch in length, and is found in nodules of varying sizes in the stomach wall itself.

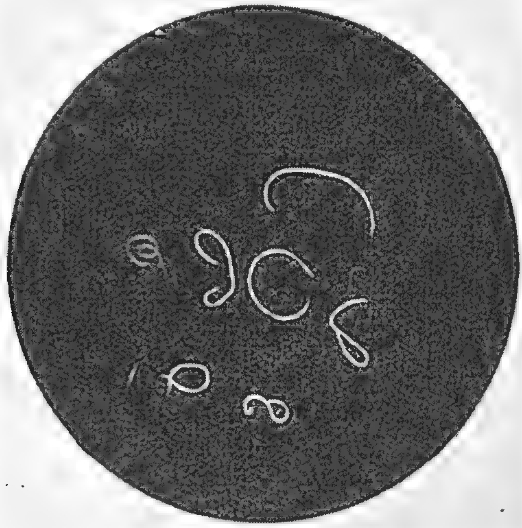

PLATE 202.—LARGE STOMACH WORM (*Habronema* spp.).
(Natural size.)

Life History.

The eggs laid by the female worms eventually reach the exterior in the dung. They must then be swallowed by the maggots of certain

species of flies which breed in horse dung. The larvæ which are developing in those maggots are still present in the adult flies when they emerge. In the adult fly they congregate in the region of the proboscis, and when the fly is attracted to the horse's mouth by the moisture there they break out of the proboscis and, reaching the mouth, are swallowed. They eventually reach the stomach, where they settle down and grow to the adult stage. Infection may also occur when live or dead flies are swallowed.

The house fly, *Musca domestica,* is of great importance around stables as the intermediate host of *H. muscæ* and *H. megastoma,* whilst in the bush its place is taken chiefly by the bush fly, *M. vetustissima,* which closely resembles the house fly in general appearance.

The stable fly, *Stomoxys calcitrans,* forms the intermediary of infection for *H. microstoma,* the larvæ in its proboscis, rather peculiarly, preventing the fly from using the proboscis as a piercing organ and compelling it to take its food by suction only. The insect is therefore no longer able to obtain blood, and to exist must attempt to live on the moisture round the horse's mouth and eyes, &c.

Effect on the Horse.

Habronemiasis, which is the name given to the disease condition caused by infestation with these three species of worms, is a very important disease in Australia, as it is considered that a large percentage of debility cases among horses is due to this cause.

Habronema muscæ and *Habronema microstoma* irritate the stomach lining, and may cause serious digestive disturbances. *H. megastoma* is the most harmful of the three species, for it burrows into the stomach wall, destroys the gastric glands, and causes the formation of fibrous nodules. Occasionally these nodules may be so numerous and so large as to interfere very seriously with the passage of food.

These roundworms may also be concerned with certain types of skin growths. These are caused by the larvæ breaking out from the proboscis of the fly when it is feeding on sores or moist places, such as the eye, and burrowing into the skin and tissues. In Australia growths in the eye and on the penis have been shown to be caused by these larvæ, and swamp cancer may also be an associated condition. In other countries "summer sores" are a direct result of larval infestation of the skin.

Treatment and Control.

Owing to its location in nodules in the stomach there is no effective treatment known for *H. megastoma.* The removal of *H. muscæ* and *H. microstoma* may be effected if the horse is previously starved for eighteen to twenty-four hours, and the stomach washed out with 8 to 10 quarts of 2 per cent. sodium bicarbonate. This should then be siphoned off. When syphoning is not carried out fifteen to twenty minutes should be allowed to elapse. Carbon bisulphide is then given at the rate of 6 cubic centimetres for every 250 lb. weight with a maximum dose of 24 cubic centimetres. No food or water should be given for another four hours.

Control is only possible so long as the manure is regularly collected and so disposed that the intermediate fly hosts are unable to breed in it. Spraying and trapping flies among stabled horses is also desirable.

General measures for a high standard of sanitation must not be overlooked. Efficient methods of manure disposal will be discussed in detail later.

Where horses are running on large pastures it is difficult to suggest any control methods that are practicable, but for obviously affected animals periodical treatment is advised.

THE SMALL STOMACH WORM (Trichostrongylus axei).

This is a small slender species, no more than about one-fifth of an inch in length, which occurs in the lining of the stomach. It has only recently been recorded from the horse in Australia, and its importance in this country is unknown.

In other countries where this parasite is present it is said to injure the stomach wall, causing lesions somewhat like ringworm in appearance. The life history is not definitely known, but is direct—that is, no intermediate host is required.

The treatment recommended for the large stomach worms is also advised for this species.

THE LARGE ROUNDWORM (Ascaris equorum).

These are very conspicuous worms, yellowish white in colour, and attaining about 12 inches in length. At the anterior end is the head bearing three distinct lips and marked off from the rest of the body by a constriction. The large round worm occurs in the first portion of the small intestine, and frequently in very large numbers, especially in young horses.

Life History.

The eggs laid by the female worms reach the exterior in the dung. Under favourable conditions of temperature and moisture a tiny embyro appears inside the egg in about fourteen days, and in this stage the egg is ready to infect other horses. When swallowed by the horse the egg hatches in the intestine, and the tiny larva that is set free immediately bores into the intestine wall, reaches the blood vessels, and is carried to the liver. From the liver it is eventually taken to the lungs in the blood stream. After a certain period of development in the lungs the larva then migrates into the trachea or windpipe, crawls up into the mouth, is swallowed, and reaches the small intestine again, where it may settle down and grow to the adult stage.

Effect on the Horse.

The large roundworm is especially harmful to young horses, and heavy infestations result in an unthrifty and stunted condition. The migrating larvæ damage the liver and lung tissue, and may cause fever and lung disorders. The adult worms, when in numbers, produce serious digestive troubles, and sometimes the worms, in bunching together, hinder the free passage of food, and symptoms of colic may be evident. The toxins or poisonous substances produced by both larvæ and adults may also be a cause of illness. Frequently infestation may be diagnosed by watching the dung in which the very conspicuous adult worms may be passed.

Treatment and Control.

Carbon bisulphide as recommended for bots is also a highly efficient drug for the removal of the large roundworm.

Turpentine may also be used, but is not so effective. The animal to be treated is starved for eighteen to twenty-four hours. For an animal weighing 1,000 lb., 2 ounces of turpentine are administered, followed by an aloes ball or 1½ to 2 pints of raw linseed oil. Both the turpentine and linseed oil should be as pure as possible.

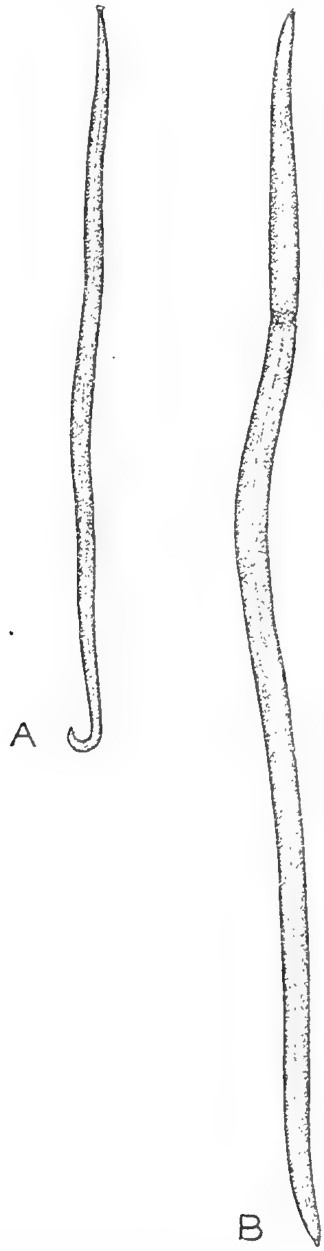

Plate 203.—The Large Roundworm (*Ascaris equorum*).
A—Male. B—Female.
(About half natural size.)

Control is possible only with strict sanitation. Treatment will remove the adults from the intestine, but has no effect upon the larvæ in the liver and lungs. The egg stage, moreover, is highly resistant to adverse conditions, and can exist for long periods in suitable places.

Removal of manure, drainage, &c., are necessary factors for the control of this parasite. Special paddocks should be reserved for the mother and foal, either new land or such as has not been used by horses for at least a year.

PALISADE WORMS (Strongylus spp.).

These worms are also known as blood worms or red worms, owing to their red colour, which is due to ingested blood. There are three species present in the horse—*Strongylus equinus*, which is the largest and may grow up to 2 inches in length; *Strongylus edentatus*, which attains a length of $1\frac{1}{2}$ inches; and *Strongylus vulgaris*, which is rarely more than about 1 inch in length. All these species occur firmly attached to the walls of the large bowel and blind gut.

Plate 204.—Palisade Worms (*Strongylus* spp.). (Natural size.)

Life History.

The eggs reaching the exterior in the manure hatch in a day or two. The tiny larva that emerges undergoes certain development, and in about a week reaches the infective stage. These infective larvæ are enclosed in a sheath which assists them to resist unfavourable conditions for long periods. They then migrate up the grass blades and are swallowed by the horse when grazing. Their life cycle in the horse is not definitely known, but it is considered to involve a movement through various organs, the liver and lungs especially, as in the case of the larvæ of the large round worm. They eventually return to the large gut, attach themselves to its wall, and grow to maturity.

Effect on the Horse.

Palisade worms injure the gut wall and live on blood. During their life cycle in the horse extensive damage to the liver and other organs, into which the larvæ may wander, may occur. Heavy infestations cause anaemia, diarrhœa, weakness, and emaciation. They have a big effect on working horses, so lowering their vitality that the horses do less and less work as the disease occasioned by the infestation advances.

Strongylus vulgaris is especially dangerous, as its larvæ invade the walls of certain arteries, especially those supplying the large bowel with blood. As a result of this invasion the walls of the artery thicken, harden, and enlarge, to form a conspicuous dilation known as an aneurism. This interferes with the circulation of blood, and as a result the large intestine does not receive an adequate supply. Sometimes complete blockages occur in these arteries. Anæmia, emaciation, and colicy conditions may arise. Occasionally portions of the aneurism may be carried into blood vessels in other parts of the body. The vessel becomes blocked by this material, and sometimes serious and fatal hæmorrhages may occur. If any of the main vessels supplying the limbs become plugged lameness may result.

Treatment and Control.

Oil of chenopodium is considered to be a highly satisfactory drug for the removal of palisade worms. This drug is given after thirty-six hours' starvation, preceded or accompanied by raw linseed oil or an aloes ball. The dose for animals two years and older is 4 to 5 fluid drachms of chenopodium with 1½ to 2 pints of raw linseed oil. Young horses six months old and over should be given 1 drachm of the drug.

For pregnant mares carbontetrachloride in doses of 6 to 12 fluid drachms is advised.

Stable sanitation is necessary for the control of the palisade worms. Low-lying paddocks of a marshy nature should be avoided as horse pastures.

SMALL STRONGYLES.

The large bowel and blind gut are also infested by small whitish and reddish worms measuring usually about ½ inch to 1 inch in length, and sometimes occurring in enormous numbers. Some of these produce

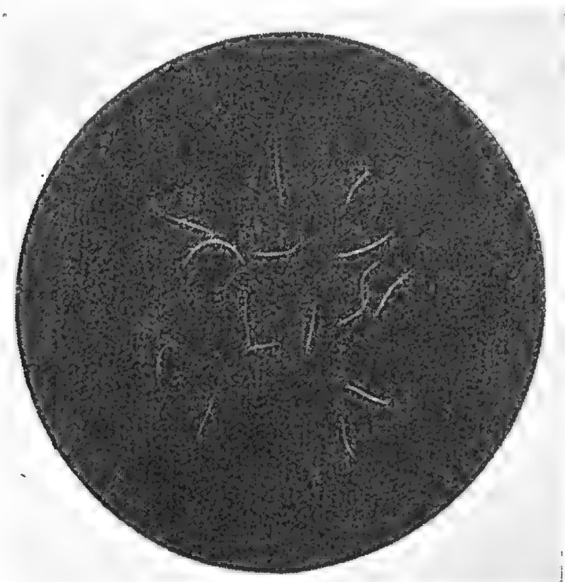

PLATE 205.—SMALL STRONGYLES. (Natural size.)

nodules in the gut wall, in which they spend the early portion of their parasitic life. The horse becomes infested when it swallows infective larvæ which are present in the soil and on the grass.

The small Strongyles contribute to the effects of gross parasitism, and assist in causing diarrhœa, weakness, anæmia, and emaciation.

Treatment and control is on the same general lines as that advised for palisade worms.

PIN WORMS (Oxyuris equi).

The female pin worm is whitish with a long pointed tail, measuring from 2 to about 6 inches in length. The male is smaller, and is seldom seen. This species infests the large bowel.

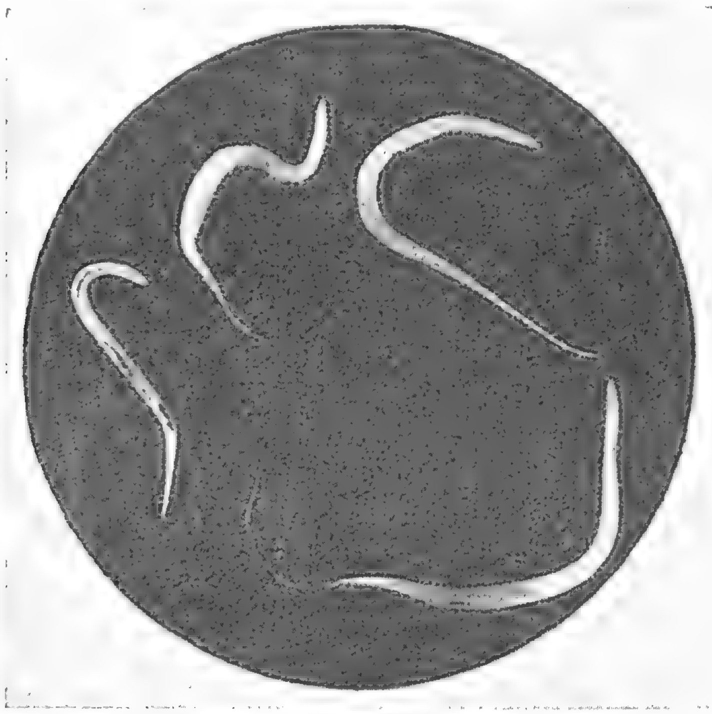

Plate 206.—The Pin Worm of the Horse (*Oxyuris equi*). (Natural size.)
(From Circular 401, University of Illinois.)

Life History.

Instead of laying eggs which may reach the exterior in the manure, the gravid female worm itself passes out in the manure, and then deposits eggs. Sometimes these females adhere around the anus, depositing their eggs in this situation, the masses of eggs having the appearance of yellow crusts. The eggs eventually become infective, and when swallowed by the horse hatch to give rise to tiny larvæ. These larvæ make their way to the large bowel, where they grow to maturity.

Effect on the Horse.

Pin worm infestation may be responsible for digestive disturbances. The clustering of the female worms around the anus causes severe irritation, which the horse attempts to relieve by rubbing or scratching.

Treatment and Control.

Turpentine or oil of chenopodium as advised for the large roundworm and palisade worms respectively is said to be satisfactory for the

removal of pin worms. A high standard of sanitation is necessary if infestations are to be controlled.

GENERAL CONTROL MEASURES.

Manure Disposal.

(*a*) The regular collection and proper disposal of all manure is an extremely important measure for the control of the worm parasites of horses.

All manure should be collected daily. It may be used for fertilizing purposes only on pastures to which horses are not admitted. In such cases it should be well scattered over the ground. This enables it to dry out quickly, and renders it unsuitable for breeding purposes by the house fly and other species.

Otherwise the manure should be stored in compact heaps, well beaten down on the top and on the sides with a shovel. The heat generated in such closely compact heaps kills any fly maggots and a big percentage of the worm eggs. To make the heap as safe as possible the outer few inches should be buried into the heap every week or so.

(*b*) The three species of stomach worms are all carried by flies which breed in manure. Fly traps should be provided in various parts of the premises. A good spray may be made by extracting ½ lb. of fresh pyrethrum in 1 gallon of kerosene for two hours.

(*c*) Good drainage and dry conditions are important both in the stables and in the pasture.

(*d*) Stable bedding should be changed frequently, and the stables should be kept as clean as possible.

(*e*) Do not allow the food to become contaminated with manure by throwing it on the ground. Place the food in well-constructed feed-boxes raised well above the ground surface. Good, clean water should be provided.

(*f*) Do not overstock on pastures, and if possible use the horse paddock for yearly periods for cattle or sheep.

(*g*) Young horses are most readily affected by parasites, and any control measures should be especially enforced where they are concerned.

By E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

PART III.

THE BERKSHIRE.

As the most adaptable of several dual-purpose types, the Berkshire occupies a prominent place in the list of breeds approved for use in this country in the production of pork and bacon pigs for both the domestic and export markets.

Introduced away back in the very early days of Australian settlement, and maintained as a pure breed by careful breeding and regular importations of fresh and unrelated blood, the Berkshire is distributed throughout the Commonwealth and New Zealand.

The first imported boar listed in the herd books of the Australian Stud Pig Breeders' Society (formerly the Berkshire and Yorkshire Society of Australasia) is "Burton Harold" (imp.), who had as his sire, "Blenheim," BB5792 and dam, "Stumpy," MDXXVII., BB6841. This boar was the grand sire on the dam's side of "Dan No. 1," the first boar to be registered. "Burton Harold" (imp. was the sire of "Violet 2nd," owned by Mr. George Madden, a veteran enthusiast in the showrings of Victoria. "Dan No. 1," was owned by Mr. T. K. Adkins, so was "Silky No. 2," the first female Berkshire registered here. Of course, Berkshires were available in pure bred form for many years prior to the establishment of a Stud Society or a stud pig herd book.

It is recorded that the Berkshire was the pig that brought repute to British pigs abroad when distribution to other countries became possible. The breed has a long and distinguished history and has earned a high reputation among butchers and curers for its evenness of lean and fat, and absence of waste. They are quick growers on a minimum ration, and with careful handling and judicious feeding can be satisfactorily finished for market, either as light or medium weight porkers or for heavier weights in pork and bacon grades.

Their original home was in West Berkshire, England. Their colour was black with splashes of white over the body. Some early records refer to the colour as brownish red; in fact, even to the present day where breeding is neglected, there is a tendency to revert to this brownish

tinge in the hair. Trade was fairly brisk, and there are records of exports of Berkshires to the United States and Canada in the year 1864. In July, 1883, R. Swanwick, A. Stewart, and H. Humphrey convened the first meeting of interested breeders at Berkeley, which led to the formation of the British Berkhire Society in 1883. R. Swanwick was the first president and H. Humphrey the first secretary. This Society prospered, and regularly issued herd books, and continued on until 1927, when it amalgamated with the National Pig Breeders' Association of England. Mr. Arthur Beale was the secretary of the Berkshire and Yorkshire Society in Australia when registration was first introduced here.

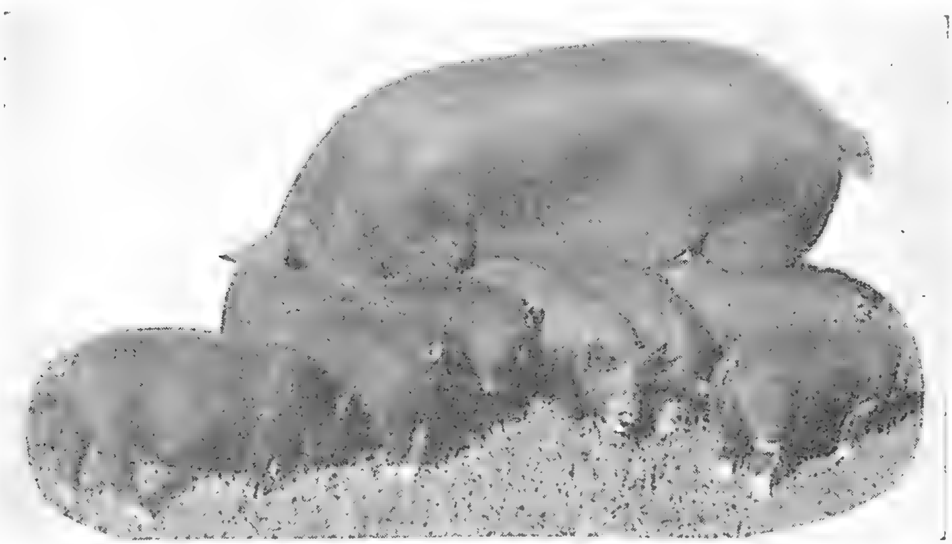

Plate 207.

Champion Berkshire Sow, with first prize litter at foot, Brisbane Exhibition 1934; "Linton Patience," imported by Mr. Frank Bach, of Oakey; a sow of excellent type and conformation.

Australian experience with the Berkshire breed confirms its overseas reputation, where the breed's claim as a producer of highest quality of pork and bacon has been proved by its repeated successes for over thirty years in show competitions of live and dressed meat, and especially as light-weight porkers. Its usefulness for crossing with larger and slower maturing breeds proved there has been borne out here, the Tamworth-Berkshire cross being a typical instance. This particular cross has for many years been the most popular of all bacon pig crosses in Australia, and even in face of competition of the Large White and its crosses, the Tamworth-Berkshire cross holds its own, although white skinned pigs are preferred for export requirements. That Berkshires are capable of producing heavy weight carcasses, if desirable, was shown in 1929, when a pair of Berkshire crossbreds scaled 6 cwt. 3 qr. 23 lb. when seven months old, an average daily gain of 1·77 lb. The supreme championship carcass at the same British livestock show was a purebred Berkshire scaling 140 lb. live weight at five and three-quarter months. There is abundant evidence in results of Smithfield carcass contests and numerous other shows in England and elsewhere where carcass contests are staged, to prove that the Berkshire can always hold its own in the keenest of competition. The same holds good in Australia.

Record Sale Prices.

Some remarkable sales were recorded from 1919 to 1923, a period of world wide high prices for stud stock. The Duke of Westminster auctioned sixty-two head of pure bred Berkshires averaging £115, the top price being 610 guineas, also 500 guineas for another at the same sale. Other high prices realised were 400, 370, 360, 310, 210 guineas, with others at prices from 200 guineas downwards. Such prices of course have never been realised in Australia, although, in comparison, Berkshires have always fared well at show sales if the quality and type is there to pay good dividends. Perhaps the record price for a Berkshire boar was that obtained for "Pamber Ugly Duckling," farrowed in 1920, and a Royal championship winner. He was noted as the record priced boar of any breed, and sold for 700 guineas for export. "Highfields Royal Pygmalion," farrowed in 1921, bred by F. Townend, a supreme

PLATE 208.

"Gatton Dell" and litter; an excellent group, representative of the very best there is in Berkshires in this country. Note evenness of conformation, well developed hindquarters and typical breed markings.

Royal champion in 1922, and sold for £500 to the Eaton stud. It would be interesting to have records of high-priced Berkshires in Australia. Mr. Edgar Humphrey, from whose article in the Jubilee issue of the Pig Breeders' Annual much of this information has been extracted, is of opinion, after a life time's experience with this breed, that it can be said with confidence that the Berkshire is as good to-day as ever it was, and can be regarded as an ideal breed for the production of light weight porkers so popular in the Old Country. The cross with the Middle White is even a better pig for this purpose, to my way of thinking, for the white-skinned progeny of this cross certainly do appeal and are most attractive, although care must be taken to avoid over-fattening.

Points of the Berkshire.

In colour, the Berkshire is black with white points, a white star or splash on the face, four white feet, and a white flag or brush on the tail, all desirable markings referred to by Mr. Humphrey as the hallmark of purity, a proof of over sixty years' pedigree breeding for improvement in quality of meat production. It has been a moot point for some years in Australia as to whether there is any difference between the

Berkshire and the Improved Berkshire, so called a few years ago when a better, more attractive, and more dished-face type of Berkshire was imported. In my opinion, there is no difference in Berkshires in these days, that is, pure bred Berkshires are all of an improved type. It is well to remember, however, that in Australia we have a type once called Improved Berkshire which differs in type and general conformation to that we now refer to as the English type; the latter being the latest production in the breed and the most popular abroad. Our illustrations show some variation, especially in formation of hind quarters and face. Objectionable features in Berkshires are few, but important.

PLATE 209.

"Goodna Model," stud sire at the Farm Home for Boys, Westbrook, and sire of first prize litter, shown with Champion sow "Linton Patience" (imp.).

There is a tendency to mismarking in many of the pigs of to-day; this practically covers all strains within the breed, and it is fairly safe to say it is difficult indeed to obtain a family of Berkshires that will produce 100 per cent. of well-marked pigs. Possibly our herd book standards are too severe and, perhaps, we should admit that many of our best-bodied Berkshires are faulty in markings. However, there appears to be a general acceptance of the position, and the result is that practically all champions in these days conform to herd book colour standards.

The boars are active and reliable workers if kept in reasonable breeding condition. The sows are good milkers and good sucklers; over-fattening and a lethargic condition are distinctly detrimental to breeding qualities and should be guarded against. It is certain that this breed will rise or fall in importance in accordance with its ability to breed freely, regularly, and abundantly. Any animal not capable of reproducing its species in a profitable way should be rigorously culled, and replaced by a more profitable animal. Many animals are ruined by over-fattening for show purposes; they do not only suffer in so far as their breeding organs are concerned, but they become knock-kneed, cow-hocked, and go down in the pasterns. One occasionally sees Berkshire sows (in particular) with a protruding tongue, an overgrown organ which they cannot control because it is too long to comfortably fit in the mouth.

This is a very bad fault. One notices some Berkshire boars and sows with such heavy drooping eyelids that the animals are virtually blind; they certainly have no full use of their eyes when in this condition, although the sense of smell is extra keen, and the animal may go for many months before being noticed. There is a tendency where breeding is neglected for the colour to fade to a brownish tinge on very coarse hair; this also should be guarded against. Sows that are clumsy and unable to satisfactorily rear a litter with a minimum of eight should also be disposed of,

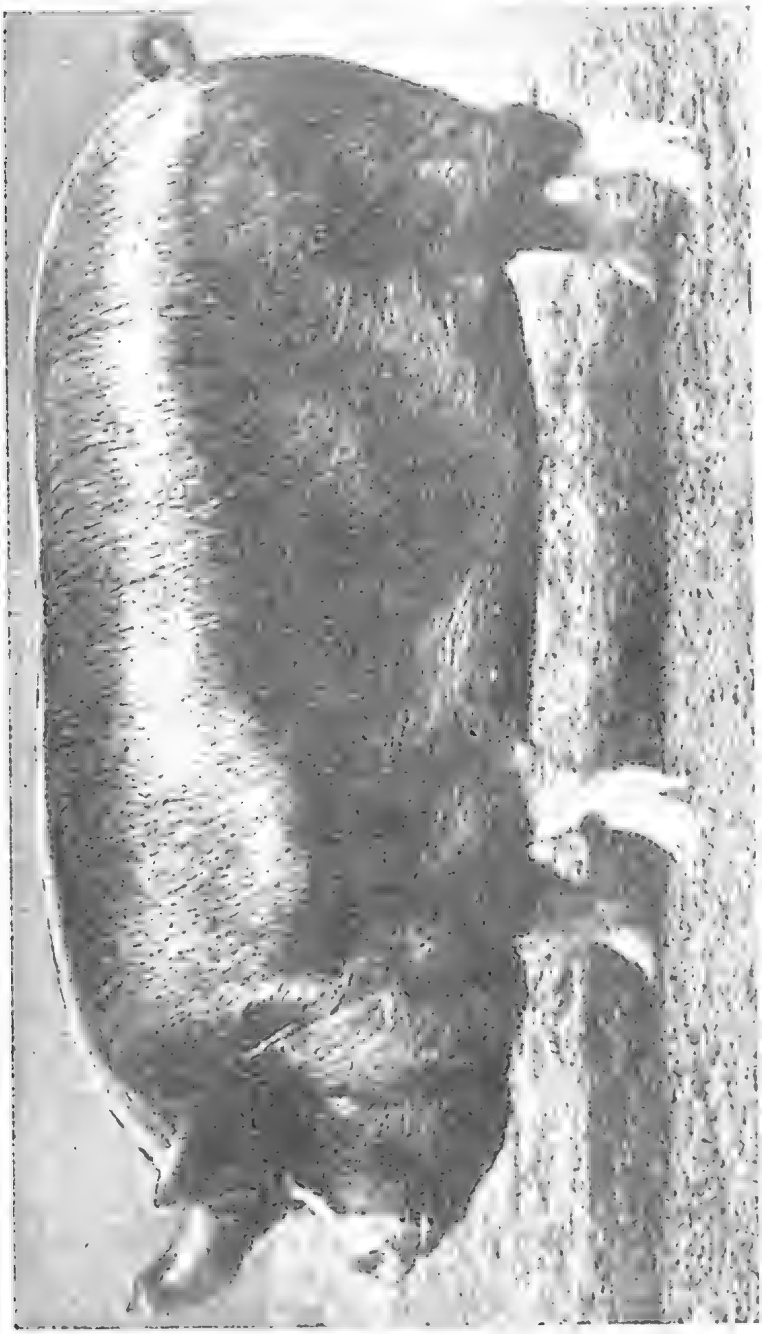

PLATE 210.

Berkshire sow of the most approved British type, "Basildon Princess Royal," supreme champion at the Royal Agricultural Society's Show, Harrowgate, England, a sow spoken of by overseas authorities as thoroughly typical of the best there is in Berkshires. Note her compact, yet roomy frame, her long deep body, and attractive appearance. The Berkshire is the most popular breed of pig in Australia, and has a wide distribution throughout the world, particularly in English-speaking countries.

for no breeding sow is profitable unless she rears eight or more well-developed pigs per litter; and there should be two litters per annum between the age of one and six years.

Prominent breeders of stud Berkshires in Queensland include the Government institutions at Gatton College, Goodna, and Willowburn Hospitals; Farm Home for Boys, Westbrook; H. Franke; M. Porter and Sons; F. Back; J. W. Handley; J. Barkle; O. L. Klein; Wide Bay Stud Piggery; Kairi State Farm and many others.

STANDARD OF EXCELLENCE FOR BERKSHIRES.

	Points.
Head and Ears.—Moderately short; face dished; snout broad and wide between eyes; ears fairly large, carried erect or slightly inclined forward, and fringed with fine hair	15
Neck and Shoulders.—Medium length, evenly set on shoulders; jowl full, but not heavy; shoulders fine, sloping backward, and free from coarseness	10
Back and Sides.—Back long and straight; loin full; ribs well sprung; sides full and deep to flank; showing straight underline; and in sows, twelve good, evenly placed teats	20
Hams.—Wide and deep to hocks tail set high on back line, and fairly large ..	20
Legs and Feet.—Legs short, straight and strong; feet set wide in line with shoulders; hoofs nearly erect	15
Colour, Skin, and Hair.—Black, with white on face, feet, and tip of tail; skin fine and free from wrinkles; hair long, fine, and plentiful	10
Character.—A combination of all points showing distinctive breeding, type, and quality	10
	100

IMPORTANCE OF COOLING CREAM.

The first step towards controlling the action of bacteria in milk and cream is to prevent such organisms as have gained access to these products from multiplying to sufficient numbers to cause trouble. The only way to do this is to cool the milk or cream as much and as soon as possible. In the absence of water being laid on to the separating room, any of the small water-bag coolers, to cool the cream straight from the separator or the milk immediately it is drawn, are very efficacious, as every degree of temperature we bring the product below 80 degrees Fahr. will have a retarding effect on the bacterial development, and in many cases (in relation to weed taints, &c.) the aeration will improve the flavour.

If a cooler is not available a lot can be done by standing the milk or cream cans in cold water, or putting wet bags round them, but it must always be remembered that fresh water is advisable each day, and the bags should be changed each day and allowed to dry. In the case of cream it should be stirred with a tinned metal stirrer two or three times each day, and not be mixed until each lot of cream is cool. Finally, it should be delivered to the factory daily, if possible.

With reference to the delivery of cream, many producers, after taking as much care as possible on the farm, allow the product to become heated in transit to the factory, either by not having a well-shaded stand or, when they do the carting themselves, by not taking the trouble to keep the cans covered (by, say, clean wet bags). This neglect may very often be fatal to quality.

Marketing Table Poultry.

By P. RUMBALL, Poultry Expert.

IN the ordinary commercial sense, table poultry is not produced to any appreciable extent in Queensland. Although this branch of the poultry industry has not yet been developed in this State, there is no reason why it should not receive serious consideration by those who may be in position to enter into what is really a specialised business.

The basis of the poultry industry in Queensland is egg production, for which breeds such as Leghorns and Australorps are bred, the former predominating. Under these conditions the class of bird which forms the bulk of poultry sold for table purposes are young cockerels of both light and heavy breeds and hens culled on account of their age, or for other reasons which have rendered them unprofitable as egg producers.

In marketing there are two distinct conditions to be considered, namely:—(*a*) Conditions which are entirely in the hands of the individual producer; and (*b*) conditions under which the birds are sold. The latter conditions, by reason of the fact that they apply to all producers selling poultry, and the fact that they do not come under the immediate control of the individual producer, are possibly the more important and therefore can take precedence.

PRESENT SYSTEM OF SALE.

Although large numbers of birds are sold privately, the greater number reach the consumer through the auction markets. A conservative estimate of the value of poultry sold daily in the metropolitan area would be in the vicinity of £250. This, to some, may appear rather a high estimate, but an inspection of the markets will convince the observant person that the estimate is, if anything, on the low side.

The birds are received by the selling agents by rail or direct from the producer in crates of all types, shapes, and sizes. They are then dumped on the saleroom floor, little effort being made by either the producer or agent in the direction of classification, and sold to the highest bidder.

Undoubtedly at times, even under these conditions, the birds tendered for sale realise payable prices, but, again, at other periods they are sold considerably under their value. The low values are, no doubt, influenced by the supply and demand, but at the same time, if the birds were classified, displayed to advantage, and put up for auction in numbers which would permit of the general householder bidding, values would be materially increased.

TRANSPORT OF POULTRY.

The conditions under which table poultry are sold undoubtedly leave room for improvement, both from a humane and a commercial point of view. From the humane point of view the crates used for forwarding birds to market should have sufficient head room and floor space for the number and variety consigned. They should be well ventilated and provided with water receptacles, the latter being firmly attached to each corner of the crate. The crates for fowls and ducks should be at least 18 inches high, and that for turkeys and geese

30 inches. This permits of the birds crated being able to stand erect without injury. The actual dimensions or area required for an individual bird naturally varies according to the numbers and variety to be marketed at one time. Crates 4 feet long by 2 feet 6 inches wide, with a partition in the middle, will comfortably hold sixteen to twenty birds, according to their size and to the prevailing climatic conditions. The object of the partition is to prevent crowding to one end and consequent losses in the event of the crate becoming tilted in transit. A little thought on the part of the producer for birds' comfort in transit would prevent overcrowding of crates. If the crates are well made they will last for some time, as well as ensure the comfort of the birds both in transit and while awaiting sale. Good crates are worth being returned from markets, which obviates the necessity of constantly constructing makeshift crates.

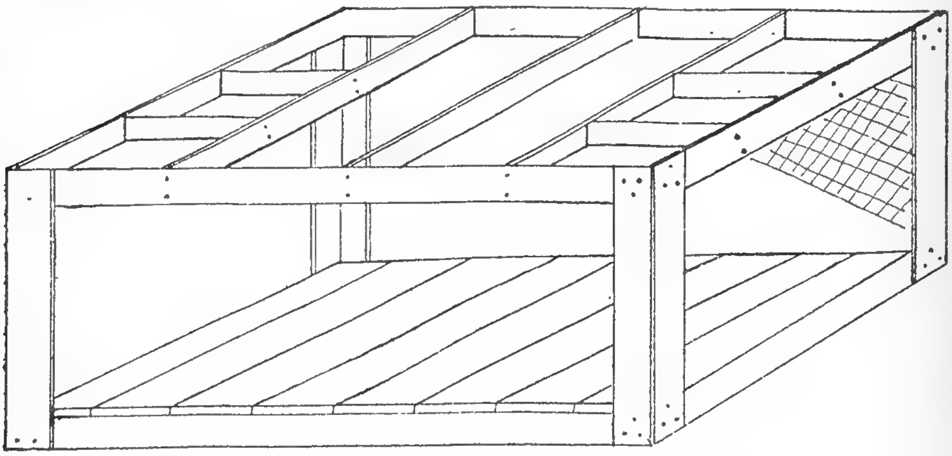

Plate 211.—A Consignment Crate for Poultry.

The sketch illustrates a crate of simple design, the measurements being 4 feet long, 2 feet 6 inches wide, and 18 inches high. It is made entirely of pine, the frame being 3 inches by ¾ inch, and the bottom 6 inches by ⅝ inch. Doors are provided in the top, and the whole structure covered with 1¼-inch mesh netting. If larger netting is used, it is desirable to place a piece of timber around the frame at least 2 inches higher than the floor to prevent the birds' legs protruding and becoming injured.

There is a correct time for marketing stock, whether they are young or old. Every day they are kept on the farm after reaching sale condition they add to farm costs. If crates are not available at the time the birds are invariably retained, possibly a week or so longer. The crates can, with a little care, be so constructed as to permit of the birds being seen to advantage by the buyers. Under the present conditions of selling, it is a few minutes' work for the assistant to burst open a crate and pass a bird or two around for inspection. Doors placed on the top of the crate would facilitate this work, allowing buyers greater time for examination.

Points in Poultry Marketing.

At present practically the only class of purchaser operating at poultry sales are poulterers and buyers for hotels and restaurants. Small buyers—that is, the household consumers—are unable to buy, for the sufficient reason that the birds are sold per crate at so much per pair. This may be necessary for the purpose of expediting sales, but it

undoubtedly restricts the consumption of poultry meat, and producers would find it to their advantage to market choice stock in small lots.

To what extent the trade of selling dressed poultry is carried on is hard to estimate. The price charged by most poulterers appears excessive, and frequently one notices very inferior stock exposed in windows for sale. There should be plenty of scope for the sale of dressed poultry at reasonable prices, providing it is as easily available to the consumer as butchers' meat and as reliable as regards quality.

Just how a dressed poultry trade is to be worked to the best advantage is difficult to say, but the first essential is a live organisation, with loyal supporters. With cold storage for holding reserves, regular supplies would always be available which would permit of contracts being made with clubs, leading hotels, and other large buyers; as well as supplying regularly, by delivery service, to private homes. Failing a delivery system, the selling of dressed poultry could be made a feature in many butchers' shops, but before this could be done organised effort would be essential.

The individual producer has to consider such questions as the time of marketing, condition of stock, grading, and crating.

Cockerels constitute possibly most of the birds that a producer has yearly for sale, and present greater difficulties by reason of the fact that they have to be disposed of during a relatively short period. They may be sold at various ages, each age having its special advantage. Although most buyers prefer young stock for table purposes, they will not pay high prices for small half-grown birds when larger hens are available, which would proportionately be much cheaper. Having this in view, it is not a desirable practice for the producer to send half-grown cockerels to the market and expect to receive good prices for them during the time when the great majority of our old hens are being disposed of on account of age. This period varies, but usually extends from some time in January until April. Young half-grown birds will find a ready sale from August until the Christmas season. After that period young stock should be well grown to command good prices, but not kept until they become staggy, which is indicated by spur growth.

It is necessary to give some attention to the general condition of the birds to be marketed. No good is done by sending stock low in condition to the selling floor. It is not suggested that any attempt be made to fatten this class of bird, as they generally are constitutionally unfit, and the producer's ends would be better served if they were destroyed, for it may happen that these particular birds will be the first to be examined by prospective buyers.

Cockerels, however, should receive some consideration and not treated, as they too frequently are, as an encumbrance and not worth feeding. If they are to be kept for any time at all they should be well treated and receive the same attention as the pullets; they have to be kept, and if they are to sell to advantage they must be well fed. Rubbish in the way of food is no good. They require, for economical growth, the same ration as the pullets. Keep them free from intestinal worms and dispose of them as early as possible.

Crating should receive the attention previously suggested, and a good layer of straw or grass placed on the floor to ensure the stock being in a clean condition on reaching the market. The birds crated together should be alike as possible as regards age, size, and condition, and of the one variety.

Seasonal Farm Crops.

By C. J. McKEON, Instructor in Agriculture.

POTATOES.

In most potato-growing districts in Queensland growers are fortunate in being able to grow two crops a year, the first, which is usually sown in August, commonly known as the spring crop; and the second, planted in February, known as the autumn crop. Provided the soil and climate are suitable and good cultural methods are adopted, potato growing can be made a more payable proposition than most other crops; and those who persist with the crop, and are not discouraged by occasional reverses as a result of disease or low prices, find them one of the most profitable crops in the long run.

Potato Soils.

The ideal soil for potato growing is a friable, well-drained, alluvial loam, and one which is sufficiently rich in organic matter to absorb and retain moisture. As a general rule, good lucerne land is also good potato land, but this does not always apply, for lucerne can be grown successfully on the heavier classes of black soil which, unless under the best of conditions, are unsuitable for potatoes. Then again, potatoes can also be grown on some of the lighter sandy loams which could not be regarded as good lucerne land. Clayey soils and those which are badly drained and liable to become water-logged should be avoided, for not only are the chances of raising a crop small, but tubers of good quality cannot be produced on soils of this nature. Even on the best soils, high yields cannot be maintained where the land has been growing potatoes continuously for a number of years, unless care is taken to maintain the physical condition of the soil by keeping up the supply of humus. This can only be done by practising a rotation of crops or by ploughing in a green crop, preferably a legume, such as field peas for winter growth or cowpeas for summer growth. Farmyard manure, where available, is also excellent for this purpose, and also possesses considerable value from a fertilizing point of view.

An early and thorough preparation of the soil is essential to get best results from any crop, but to none does this apply more than to potatoes. Farmers who spend the extra time and labour required to put the land in first-class condition for potatoes will be more than repaid, especially if a dry spell is experienced during the growth of the crop. Under the most favourable conditions good crops may be produced on land that has received a hurried and rough preparation, but in any district the odds are greatly against these conditions occurring other than at rare intervals, and, consequently, the necessity for thorough preparation of the land cannot be stressed too strongly.

Plate 212.—A Wheatfield at Upper Freestone, near Warwick.

"Leave the bustle all behind you; come and let contentment find you
In a cosy little cabin lyin' snug among the wheat."

The first ploughing should be to a depth of at least 9 inches, which will ensure that the seed when planted will have 3 or 4 inches of worked soil beneath it. The land should be left to fallow for a couple of months at least before planting time, care being taken in the meantime to deal with any weed growth which may appear. The use of a spring tooth cultivator or other suitable instrument will not only deal with weed growth, but will maintain the surface soil in good condition. Land prepared in this way will almost invariably be in a sufficiently good condition at planting time to ensure a good germination.

Varieties.

The question as to the most suitable varieties to grow is one that the grower himself will have to determine, either as the result of his neighbours' experience or by conducting trials of his own. Of the white-skinned varieties, Carmens and Scottish Triumphs are by far the most widely grown. Both are good yielding varieties and always command a good price in the markets. Up to Dates also do well in some localities, and come next in order of popularity. Of the blue-skinned varieties, Manhattans are at present the most popular, and are also the most reliable variety. In certain localities Guyra Blues

also give good results, but they do not do well in all districts. Satisfactions and Rough Skinned Brownells are the most widely grown of the red-skinned varieties; neither, however, should be planted in any quantity without first giving them a trial, as they only do well in certain localities.

As growers are compelled, by reason of the fact that locally-grown seed is not available, to use seed which has been imported from the Southern States for the spring crop, every effort should be made to secure seed supplies from a reliable firm of merchants. It is far better to get seed which will prove true to name of the variety which is known to suit the locality, even though it may cost a little more, rather than obtain a cheaper line of seed which may turn out to be anything but the desired variety.

Providing the spring crop is planted early, seed from this can be used for planting the autumn crop planted in February.

All seed, especially that used for the spring crop, should be treated with formalin before planting, otherwise there is a serious risk of disease being introduced. Anyone who may be interested in this treatment can obtain full particulars by making application to the Department of Agriculture.

Any tubers which are not perfectly sound or which, on being cut, show a suspicious looking discolouration should be rejected.

Seed for the spring crop may be cut, but this practice is not advisable in the case of the autumn crop, for hot, wet weather is frequently experienced during February, and, consequently, the cut seed is likely to rot in the ground. Where cut seed is used, the cutting should be done the day before to allow the cut surface to dry. Sprinkling with wood ashes is a practice which is frequently adopted, and is a good one.

Much will depend on the size of the potatoes as to the best way to cut them, but as a general rule the smaller tubers should be cut in half lengthwise, and in the case of the larger tubers the stem end should be cut off at about a third of the length of the tuber, the remaining portion being cut through the centre lengthwise, thus making three sets.

Planting.

Although there are machines for planting, the general practice is to plough the seed in, the seed being planted in every third or fourth furrow according to the width of the plough cut. This practice has much to recommend it, as the furrows are not allowed to remain uncovered for any length of time and the seed can be spaced at an even depth and distance apart. The usual distance between the sets is, approximately, 15 inches at a depth of about 4 inches. They should be planted on the side of the furrow to prevent the horses tramping on them, as would be the case where they were planted along the bottom of the furrow.

The quantity of seed required per acre will naturally depend on the size of the tubers and whether cut or whole seed is being used, but, as a general rule, about 7 cwt. per acre is sufficient.

Cultivation.

The first cultivation should be carried out as soon as the young plants appear above ground. A light tine harrow, preferably a lever

harrow with the tines set back, is the most suitable implement. This cultivation will not only break up the surface soil which may have become slightly caked as a result of rain following planting, but will also destroy any weed growth which has sprung up between the plants. This will be the last opportunity of doing this, for all future cultivations can only be carried out between the rows. The number of inter-row cultivations required will depend on seasonal circumstances, but should be sufficient to keep weed growth in check and, at the same time, keep the surface soil in a friable condition.

When the plants reach the flowering stage they should be hilled; an effective and popular way of doing this is by fitting hilling attachments to an ordinary scuffler. The main advantages to be derived from hilling are that the tubers are protected from the potato moth, and it also prevents tubers which might otherwise have been exposed from becoming discoloured.

PLATE 213.—A FINE WHEAT CROP AT CAMBOOYA, DARLING DOWNS.

". . . A pleasure in a measure for a man who likes the game."

During growth every precaution should be taken to protect the crop against an attack of Irish Blight, and where there is a likelihood of this occurring, regular sprayings with Bordeaux mixture should be carried out. Frequently, sprayings are not commenced until the disease appears, and it is usually then too late. Spraying with Bordeaux mixture is purely a preventive and not a cure for the disease as many people imagine, and to be successful should be carried out before the disease appears. Full particulars of the preparation and use of Bordeaux mixture appear in a publication on Potato diseases which may be obtained from the Department of Agriculture.

Harvesting.

Regarding harvesting, in the case of the spring crop this is usually carried out as soon as it can safely be done, one of the chief reasons being a desire to get the potatoes on the market as early as possible, as good prices are usually obtainable at the commencement of the season.

The hot weather, and the risk of damage by potato moth, also make it necessary to harvest the crop as soon as possible. In their anxiety to get the potatoes on the market as early as possible growers frequently make the mistake of digging them before the skins are firm enough, with the result that they arrive on the market in a badly rubbed condition and consequently bring a reduced price.

Harvesting is still very largely carried out with a digging fork. A plough is also used at times to turn the tubers out, but although this is a quicker method than hand digging the crop cannot be harvested as thoroughly.

The tubers after being dug should not be left exposed for any length of time to the hot sun, and should be bagged and removed from the field as quickly as possible. When the potato moth is prevalent, on no account should the bagged tubers be covered with the tops or haulms while standing in the field, for this is one of the surest ways of introducing the moth to the bagged tubers.

When preparing them for market they should be carefully graded, for a nice, even-sized line of potatoes will almost invariably command a better price than an uneven sample. Care sould also be taken to reject any tubers which are damaged or showing signs of moth infestation.

SORGHUMS.

Judging by the number of letters that are received from time to time by the Department of Agriculture for information regarding sorghums, it would appear that a considerable amount of confusion exists regarding the different groups. Those of importance as far as this State is concerned may be classified into the following groups:—Saccharine sorghums, Grain sorghums, and Grass sorghums. Broom millet, which is used for the manufacture of brooms, is also a member of the sorghum family. The saccharine or sweet sorghums are one of the most valuable and widely grown fodders throughout the dairying districts of the State, and when cut at the right stage provide not only a nutritious fodder but also a great bulk of fodder. The sweet juices contained in the mature stalks make them highly palatable to dairy and other stock. Although not quite so nutritious as maize, good crops of sorghum can be produced under conditions that would be fatal to maize. Sorghums also possess the advantage of remaining in a succulent stage for a considerable period after reaching maturity, whereas maize rapidly dries off on reaching maturity.

Although the heaviest crops are naturally produced on the more fertile soils, sorghums can be grown successfully on a very wide range of soils; in fact, it can be claimed for them that they will grow on a greater variety of soils and over a wider area of the State than any other cultivated summer crop. Owing to their hardiness and ability to withstand prolonged dry spells better than most other crops, they are of great value to stock owners during dry periods when there is a scarcity of grass or other succulent fodder.

Land Preparation.

To get the best results, it is just as necessary that the land should be thoroughly prepared prior to planting as would be done for any other crop. Owing to their hardiness and their ability to thrive under adverse conditions, less attention is frequently paid to the preparation of the

land for sorghums than crops such as maize, and whilst reasonably good crops are produced under these conditions, much heavier and more even crops will be obtained on well-prepared land.

Planting can be carried out at any time after all dangers of frosts is over and as soon as weather conditions are suitable.

PLATE 214.—A GOOD STAND OF WHEAT ON A FREESTONE FARM.

"For growin' things . . . it makes life sort o' sweet,
An' your conscience never swats you if your game is growin' wheat."

Sowing.

The seed is frequently sown broadcast, but under average conditions this method is not nearly as satisfactory as sowing in drills. This applies particularly to districts where weed growth is prevalent, as it is not possible to keep weed growth in check while the young plants are becoming established. A broadcast crop is also much more difficult to harvest than one sown in drills, and the crop is also much more likely to lodge during wind storms, and where this occurs, particularly in a tall crop, it will remain down and in a tangled position and the harvesting costs are greatly increased. The only advantage to be gained by broadcasting is that a finer stalk is produced. When sown in rows the usual spacing between the rows is about 3 feet, an ordinary maize planter fitted with a suitable seed plate being very satisfactory for the purpose. Where no planter is available, furrows should be opened out with a single furrow mould-board plough to a depth of 4 to 5 inches and the seed dropped thinly by hand in the furrows. A light harrow should be then run along the drills to cover the seed.

Approximately 5 lb. of seed will be sufficient to sow an acre when sown in this manner.

Cultivation.

Sufficient cultivation should be carried out between the rows during the early stages of growth to keep the soil in good tilth, and at the same time to keep down weed growth.

The crop is at its most nutritious stage when the grain is well formed, but still in the thick milk stage, and if the crop is to be used

for converting into silage it should be cut at this stage. Where it is required for feeding in a green state, much of it will be naturally advanced much beyond this stage before it has all been cut, but it will still be of considerable food value even for some time after the leaves have been more or less killed by frost.

It is an excellent crop for silage, and when being harvested for this purpose the quickest and cheapest method of doing so is with a maize binder which cuts one row at a time and ties the stalks in bundles. Very few of these machines are in existence in this State, however, and the crop is usually cut by hand with a cane knife.

Varieties.

Numerous varieties of saccharine sorghums have been grown in this State at different times, but only a small number of the best of these have become popular.

Of the quick maturing varieties, Early Amber Cane is the most popular, but it is a light yielding variety when compared with some of the others, and for that reason is not grown extensively.

Saccaline is the most popular variety at the present time and has quite deserved its popularity. It is a tall growing, leafly variety which grows to 11 and 12 feet in height and takes approximately four to four and a-half months to mature. It also has the reputation of retaining its succulence for a longer period after being frosted than most other varieties. Unfortunately much of the seed now available shows signs of inoculation with other varieties, and growers who have pure seed should retain their supplies for future requirements from their own crops. Pure saccaline seed should be a brick red colour.

Planters' Friend or Imphee.

This is a very old and popular variety, and although not so popular generally as Saccaline, still retains its popularity in some districts. It is a very heavy yielding variety and grows under good conditions to much the same height as Saccaline.

White African.

This is another tall growing, heavy yielding variety, but so far has not been grown to any extent in this State. In some of the coastal districts it has given excellent results during the past two or three years and is increasing in popularity.

The varieties already mentioned are those that have so far given the most satisfactory results in Southern Queensland at least.

Honey Sorgho.

In the northern portion of the State a variety called Honey Sorgho has given very good results during recent years and is now very popular. This variety, however, has never become very popular in Southern Queensland.

Grain Sorghums.

The grain sorghums are grown almost entirely for their grain and are not of anything like the same value for fodder purposes as the saccharine sorghums. The stalks do not contain sweet juices like the saccharine varieties, being of a more pithy nature. The yield of forage is also much lower. They are, however, capable of yielding large

quantities of grain which in food value is almost equal to maize. They also have the advantage of being capable of producing a crop of grain on soils which are quite unsuitable for maize, and they are also capable of producing a crop under climatic conditions which would be fatal to maize.

The grain is of considerable value for poultry and stock feeding purposes. The same cultural methods should be adopted as for the saccharine varieties.

Harvesting.

Harvesting has so far been largely carried out by hand, or where a suitable machine is available, the stalks may be cut and stooked in bundles until the grain is thoroughly dry. The heads are then cut off and threshed by a hackler or other suitable machine. Care should always be taken to see that the grain is sufficiently dry before being threshed and bagged; otherwise heating is likely to occur. The fact that so much hand labour is required for harvesting the crop has probably been the reason that grain sorghums are not grown more extensively in Queensland. The Department of Agriculture is at present conducting trials with a large number of varieties from overseas, and amongst these are some highly promising dwarf varieties which, when mature, are only about 3 feet 6 inches high. Should these varieties prove to be good yielders of the right class of grain, the cost of production will be considerably lessened, as harvesting of these can be carried out with a wheat harvester as is being done in U.S.A. at the present time.

Of the large number of varieties which have been grown in the past Feterita, Standard Milo, and Cream Milo have proved the best yielding and most suitable varieties. Red Kaffir has also been grown fairly extensively. Any of the varieties mentioned are capable of giving a yield of sixty bushels of grain per acre under average conditions.

Regarding the grass sorghums, Sudan grass is the only one that is cultivated extensively, although in the past Johnson grass was also cultivated to some extent, but those who were unfortunate enough to introduce it to their cultivation paddocks have never ceased to regret having done so. Whilst it is an extremely hardy crop and also a very useful fodder at the right stage, it is extremely difficult to eradicate and becomes a serious pest. Sudan grass is a very valuable fodder crop and may be used for grazing off, converting into hay, or for silage purposes. It is particularly suitable for the more inland and drier districts, where it is now grown in preference to any other summer fodder crop.

Under reasonably good conditions at least three cuttings may be expected during the season. It is usually sown broadcast or with a seed drill. It is also sown in some districts in drills spaced wide enough to permit of inter-row cultivation being carried out. The quantity of seed required to plant an acre will vary from 5 to 15 lb. according to the method of sowing. Sowing should be carried out as soon as possible after the danger of frost is over, to permit of as many grazings or cuttings being made as is possible.

Grazing Risks.

Although Sudan grass is grown in very large areas each season and is frequently grazed in all stages of growth right throuhout the growing period, there is always a risk in allowing stock on a crop before the flowering stage is reached. It will readily be admitted that thousands

of dairy stock are grazed on the crop each season, particularly in the Darling Downs and Maranoa districts, and suffer no ill effects. Cases of poisoning, however, do occur and serious losses result, as instances have come under the notice of the Department of Agriculture where a large proportion of the herd was wiped out. For a very long time the general opinion was that pure Sudan grass was not poisonous at any stage of growth, and that poisoning only resulted on crops which had been inoculated with other varieties of sorghum. This, however, does not appear to be the case, as in several cases that have been investigated, there was no evidence that the crop was not pure. Past experience would appear to definitely indicate that the risk attached to grazing or an immature crop is very slight if the crop has been well grown. Where a crop has received a severe check from dry, hot weather and the growth is stunted, and this applies particularly to a ratoon growth, there certainly is a very serious risk attached to grazing the crop off before it flowers.

Plate 215.—Another Good Wheat Crop at Cambooya.

"I am the song that the need of man has sung
From the soil at his feet."

The saccharine and grain sorghums are very definitely dangerous before reaching the flowering stage, and whilst it is claimed that certain varieties are less poisonous than others, this has not yet been definitely proved, and consequently it is not advisable to take the risk with any of them.

SUMMER GRAZING CROPS.

Cowpeas.

As farmers are now busily engaged in preparing land for summer grazing crops, some of the most useful of these will be briefly discussed in these notes. One of the most valuable of these is cowpeas, and although they have been grown for a great number of years and have proved conclusively that they will thrive over a wide area of the State and on a wide range of soils, they are not grown as extensively as they

might be. Their value as a green manure crop is much more widely recognised than their value as a fodder crop. They make a highly nutritious hay, but they are not an easy crop to harvest and cure and consequently are not widely grown for hay purposes.

For dairymen no more valuable crop could be grown for grazing purposes. Some difficulty is usually experienced at first in getting dairy stock to take to them, but once they acquire a taste for them they eat them readily, and their value as a milk producer will then be quickly demonstrated.

One of the best ways of getting the stock accustomed to them is to make a light sowing of maize or other strong growing crop amongst the peas. The trailing or twining varieties will twine round the maize stalks and the stock cannot avoid eating them whilst eating the plants of the other crop, and in this way will acquire a taste for them.

They can be grown on most classes of soil, provided the drainage is reasonably good, and they do not require any more favourable weather conditions than the average crop.

They will not thrive under cold conditions and should not be sown until all danger from frost is over. They are frequently sown broadcast, but sowing in drills is to be preferred. The usual width between the rows is 2 feet 6 inches to 3 feet with 8 or 9 inches between the plants. For broadcast sowing from one half to one bushel of seed is required to sow an acre, according to the size of the seed. When sown in drills from 5 to 15 lb. will be necessary.

When used for grazing purposes they not only prove a valuable milk-producing crop but will greatly improve the soil after the residue has been ploughed under.

Where the crop is grown solely as a green manure crop, difficulty will be experienced in satisfactorily ploughing under a heavy crop if the work is not carried out in a proper manner.

To do this successfully, the crop sould be first of all flattened by rolling, and where a disc cultivator is available the process of ploughing the vines under will be more easily and effectively done if this machine is run over the rolled crop before commencing ploughing. The best stage at which to plough the crop in is when the pods have developed, but before they have started to ripen. A crop which has been allowed to mature too fully will become woody and consequently more difficult to plough under. As was previously mentioned, properly cured cowpea hay is very nutritious and it is also very palatable to stock. In curing, a certain amount of care is necessary to prevent loss of leaf. To avoid this the cut crop sould not be allowed to remain exposed to the hot sun for too long a period, and should be placed in loosely built cocks or heaps before the leaves become brittle. To effect an even cure the cocks should be turned occasionally.

The most popular varieties are Black and Poona. The Black is a very old and popular variety which has proved to be a heavy cropper.

The Poona variety has come more into prominence during recent years and is now very popular in some districts. It is also a heavy cropper and can quite easily hold its own with the Black variety in this respect.

Quite a number of different varieties are grown throughout the State, but the two varieties mentioned are the most widely grown.

Soy Beans.

Considerable interest has recently been shown regarding the growing of Soy beans. The Department of Agriculture has been conducting trials with these over a number of years, and whilst excellent results have at times been obtained the difficulty so far has been to secure varieties which will give consistently good results.

Other countries which are now growing them extensively experienced much the same difficulty at first, but once this problem has been overcome they have proved a valuable crop.

Although they are highly valued as a human food in countries such as Japan, their chief value in this State, for some time at least, would be for fodder and soil improvement purposes.

Plate 216.—A Paddock of "Pusa" at Pilton.

" Wheat, wheat, wheat! Oh, the sound of it is sweet!
I've been praisin' it and raisin' it in rain an' wind an' heat
Since the time I learned to toddle till it's beaten in my noddle
Is the song I'm singin' you of wheat, wheat, wheat."

The seed is valuable for oil extraction purposes and also for the manufacture of Soy bean flour, but it is doubtful if the seed could be produced here for the price at which it can usually be imported from countries where labour is cheap.

The plants contain a very high percentage of protein, and as they are palatable to stock either as a green fodder or in the form of hay, they would be of value for this purpose alone.

They also have a beneficial effect on the soil, and in countries where they do well are greatly valued for this purpose.

The results of the trials so far conducted would indicate that this crop will grow on most reasonably good soils provided the drainage is good. The young plants are fairly tender, and for that reason the surface soil should be well worked and should not be allowed to become caked prior to germination. Once the plants are established they are

fairly hardy and will stand a dry spell as well as most other crops. They are susceptible to frost, and sowing should therefore be delayed until all danger of frost is over.

The seed should be sown in rows spaced at least 2 feet 6 inches apart with about 6 inches between the plants. They should not be sown deeply, a depth of 3 inches in a well-worked soil being sufficient. The seed of the different varieties varies greatly in size and consequently the quantity of seed required to sow an acre varies. Approximately 5 lb. of seed is sufficient for the small seeded varieties and about 10 lb. per acre for the large seeded varieties.

If the crop is being grown for hay purposes it should be cut when the seeds are about half formed.

To prevent loss of leaf the same care would be necessary in curing the crop as would be the case with cowpeas.

A crop that is grown for seed should be cut when about three-quarters of the pods are ripe. The pods do not all ripen at the same time, and if the cutting were delayed until all the pods had ripened many of those which ripened first would have shed their seed. The seed should be allowed to dry out thoroughly before being threshed and bagged, as it heats very readily where this is not done.

Regarding varieties, a large number have been tried so far, and those which have shown the most promise are Otootan, Biloxi, and Laredo, particularly the two former. Otootan is the most leafy and lightest stalked of these varieties, and shows distinct promise as a fodder variety. The other two varieties are also tall-growing, leafy varieties, but are not as fine-stalked as Otootan.

From a grain point of view, Biloxi would probably prove the most suitable variety. These are fairly late maturing varieties and should be sown not later than November in the coastal districts and earlier than that in districts where early frosts may be experienced.

Of the quick maturing varieties, none has shown more promise than one known as A.K. 2. This variety was introduced last season by the Ford Motor Company and the seed was kindly forwarded to the Department of Agriculture for trial purposes.

To save any disappointment to those who may wish to secure seed of Soy beans it is as well to point out that until something more definite is known regarding the suitability of the different varieties only sufficient seed is being retained for experimental purposes. No variety has yet given consistently good results to recommend their growth in preference to cowpeas.

Millets.

For a quick growing summer grazing or hay crop, particularly for the coastal districts, the millets, or what are commonly known as panicums, have proved the most suitable. They can be grown on almost any soil that could be classed as worthy of cultivation.

They are usually sown broadcast at the rate of 12 to 15 lb. of seed per acre. They can be sown as soon as frosts are over and, given favourable weather conditions, will provide good grazing within five or six weeks from the time of sowing. They should not, however, be grazed too early but should be allowed to reach a height of 8 or 9 inches when they will have usually a sufficiently strong root growth to stand grazing.

If the crop is not allowed to become too mature before being grazed, a good second growth will appear, which can either be used for grazing purposes or for converting into hay.

When being used for hay the crop should not be allowed to mature the seed, but should be cut when the grain is forming.

Apart from the loss of food value in an over-matured crop, most varieties shed their seed freely, and this will germinate freely the following season. This would be of little consequence where the same land was again required for this crop, but where a crop such as maize or potatoes was to be grown, extra work would be entailed in cultivation to deal with the volunteer growth.

Plate 217.—Wheat Lands at Upper Freestone, Darling Downs.

"Wheat, wheat, wheat! Oh, the people have to eat!
An' you're servin' and deservin' of a velvet-cushion seat
In the cocky farmers' heaven when you come to throw a seven;
An' your password at the portal will be wheat, wheat, wheat."

It will be found that most varieties dry out more slowly than most other hay crops, but when properly cured make a very nutritious hay.

They are also of value for silage purposes either for mixing with a heavier stalked crop such as maize or sorghum or for using alone.

When used for this purpose the crop is much more easily handled both in the field and while being ensiled if cut with a reaper and binder.

Of all the varieties grown, White Panicum and Japanese Millet have given the best all-round results. They not only have proved to be heavier yielders, but are better stoolers and provide better grazing.

The best of the other varieties are Hungarian and Manchurian Millet and what is commonly called Giant Panicum or Liberty Millet.

Grasshopper Control.

By ROBERT VEITCH, B.Sc. Agr., B.Sc. For., F.R.E.S., Chief Entomologist.

GRASSHOPPERS have been hatching out in abnormally large numbers in Southern and South-Western Queensland during the past two weeks, and agriculturists and pastoralists in the infested areas are faced with the prospect of very serious losses of crops and pasturage if adequate and immediate steps are not taken to deal with the generation of hoppers that is now emerging.

The Present Outbreak.

Eggs were laid by winged grasshoppers in May of this year, and these eggs overwintered in the soil until the middle of September, when the young hoppers commenced hatching out. Many are still on the egg-bed sites or comparatively close thereto, and relatively little damage has as yet been inflicted. The ground in some places is almost black with the young hoppers, but in spite of their numbers the situation is not yet out of hand and control can be established if immediate action is taken. Once they have reached the winged stage, however, the control of plague grasshoppers is virtually an impossibility, and it is generally considered essential to deal with the hoppers not later than three or four weeks after their emergence from the egg-beds and while they are still wingless.

Control Measures.

Many measures have been recommended for dealing with grasshoppers, but the use of poisoned bran bait has practically displaced all other methods of fighting these pests except in very cheap labour countries.

Arsenic in various forms is employed as the poison in the bait, the arsenical generally used being sodium arsenite.

The following is the formula of a bait that has proved very effective:—

Arsenite of soda	½ lb.
Molasses	4 lb.
Bran	24 lb.
Water	3 gallons.

The arsenite of soda, or sodium arsenite, which is best obtained in a powdered form so that it is readily soluble, should be dissolved in hot water, the solution being then allowed to cool. The molasses is subsequently added and the mixture stirred until the molasses is thoroughly dissolved. This mixture is then added to the bran, which is worked up until a good crumbly mash is obtained. The mash should trickle through the fingers and should not be made mushy by the addition of too much water. As far as practicable it is desirable to avoid mixing the bait by hand especially if cuts are present, and it is, of course, essential to wash the hands thoroughly after the preparation and application of the bait.

The bait as prepared is broadcasted in a very finely divided state over the ground infested by the young hoppers, and experience indicates that the quantity prepared according to the formula just given is sufficient to treat two-thirds of an acre. In cases where the

grasshoppers are advancing in swarms the bait may be scattered over a 30 to 50 feet wide strip in front of the advancing hoppers. The bait is generally best applied in the forenoon, but local observations may indicate that application is desirable at some other time of the day. The important point to note is that hoppers habitually feed during the day, and the bait should be scattered when they are both active and hungry. Those using the bait should accordingly make sure that it is being eaten readily by the hoppers and, if necessary, should alter the time of application to ensure early and active feeding on the newly applied bait.

The young hoppers do not commence dying until about twenty-four hours after feeding on the bait, but when forty-eight hours have elapsed the mortality is high. In the late afternoon the hoppers congregate on small shrubs and tufts of grass, and on dying they fall to the ground. Hence if one looks under such a shrub or tuft of grass on a baited area one can find literally thousands of dead hoppers although numbers of dead are also scattered about in the open. Queensland experiments have demonstrated that poisoned bran bait gives an excellent kill of the hoppers, and as an efficient and inexpensive control measure is available, primary producers are strongly advised to use the weapon that is placed in their hands.

The degree of safety associated with the application of this bait is a matter of considerable importance, and with respect thereto the position is that it contains an arsenical poison, and it must accordingly be prepared and applied with discretion. The bait must be scattered in a very finely divided flaky state and not in lumps that can be picked by by stock. Fowls should not have access to it, and the utensils in which it has been mixed or in which it is stored should not be accessible to live stock. The position would appear to be that if intelligently applied the danger to stock is nearly negligible. Enormous quantities of poisoned bran bait are used throughout the world for the control of grasshoppers, and the general opinion seems to be that the element of risk entailed in its application is very slight. Of course, as already indicated, the bait must be used with discretion and every reasonable precaution taken to ensure its safe application, for obviously no guarantee can be given that nothing can possibly go wrong.

As already stated, the use of poisoned bran bait is the standard measure for grasshopper control. Another control measure is, however, worthy of mention as a temporary expedient—namely, the dragging of burning old bags or similar material over the dense swarms of young hoppers. Such bags may be sprinkled with kerosene, and on being lit and dragged over the infested area it will be found that large numbers of hoppers have been killed. Such a control measure is, of course, much more laborious and not nearly so efficient as the baiting system already described. Nevertheless it may serve a useful purpose until the necessary ingredients for baiting are obtained.

A PROGRESSIVE JOURNAL.

A farmer writes (10th September, 1934):—"The Journal, always admirable, has continued to make progress, and in its present form is a publication reflecting great credit upon all responsible."

PLATE 218.
Champion A.I.S. Butter-fat Cow at the Brisbane Show, "Evelyn of Sunnyview," the property of Mr. J. Phillips, Wondai.

Plate 219.

Champion Jersey Cow at the Brisbane Show, "Oxford Ginger Girl," the property of Messrs. G. Hutton and Sons, Wamuran, Brisbane Valley.

PLATE 220.

Champion A.I.S. Cow at the Brisbane Show, "Myrtle IV. of Lemongrove," the property of Mr. J. Phillips, Wondai.

Plate 221.
Champion Ayrshire Cow at the Brisbane Show, "Fairview Lady Bess," owned by R. M. Anderson, Myola, Southbrook.

Answers to Correspondents.

BOTANY.

Hexham Scent.

F.C. (Wynnum West)—

The specimen represents *Melilotus parviflora*, the Melilot or Hexham Scent. It is a plant resembling lucerne in appearance, and is quite common at this time of the year, growing until about October or November, when it dies off with the approach of hot weather. It was much boomed some years ago as a fodder under the name of King Island Melilot, but, on the whole, our experience in Queensland has been that stock do not take readily to it. It has a value for growing on land where other legumes will not thrive, but has the bad property of tainting milk and cream. It is quite common on the Darling Downs, and sometimes the seeds get mixed in with wheat, and, owing to their peculiar odour and flavour, cause a good deal of trouble.

Burr Trefoil; Prairie Grass.

W.G.B. (Bancroft)—

The specimens have been determined as follows:—

1. *Medicago denticulata*, Burr Trefoil. A vigorous-growing Trefoil, very common about this time of the year in parts of Queensland. It is quite a valuable forage, but dies out on the approach of the hot weather, about October or the middle of November. When it dies down it leaves a mass of burry pods, but these are greedily eaten by sheep, and the damage they do to the belly wool is more than counterbalanced by the forage features. In its green and luscious state it is apt to bloat stock rather badly.

2. *Medicago minima*, the small Burr Trefoil. Much the same remarks apply as to No. 1.

3. Prairie Grass, *Bromus unioloides*. One of the best known winter fodders. It very often comes up spontaneously in cultivated ground. It is an annual grass, and dies out in early or late summer.

Portuguese Elm; Bauhinia.

E.J.C. (Caboolture)—

The specimens have been determined as follows:—

(*a*) *Celtis sinensis*, a native of Western China. It belongs to the Elm family and is often called in Queensland Portuguese Elm. It makes an excellent shade tree and the leaves are much relished by stock. The tree is propagated from seeds which are borne in abundance, if we remember rightly, about January or February. Though we have not tried to do it ourselves, we think there is a good possibility of striking the plant from cuttings.

(*b*) *Bauhinia variegata*, a native of India, China, and Java. A very handsome tree, much cultivated in tropical and subtropical countries on account of its showy flowers. There is a form with pure white flowers (*Bauhinia candida*).

The Scarlet Pimpernel; Groundsel.

M. D. O'D. (Gympie)—

1. *Anagallis arvensis*, the Scarlet Pimpernel, a common European weed now abundant in Queensland and the Southern States. It is recorded as poisonous, but is mostly left untouched by stock. Some years ago, however, we received a number of seeds from the paunch of a cow that had been poisoned at Buderim Mountain, evidently through eating this plant. Dr. Gilruth has also recorded poisoning of sheep in Victoria through it.

2. *Baccharis halimifolia*, the Groundsel Bush, very common now on the North Coast line, favouring country on the coast subject to inundation, but by no manner of means confined to such places, for it is found on the Blackall Range and in other localities. It has been accused of poisoning stock, but feeding experiments carried out with it some years ago at Yeerongpilly showed the plant to have no feeding value whatever, but not to be definitely poisonous.

Cape Cotton.

O.C. (Macalister)—

The plant is *Gomphocarpus fruiticosus,* commonly known as the Balloon Cotton or Bladder Cotton, and sometimes as Cape Cotton. It is a native of South Africa, and is now a common naturalised weed in parts of Queensland, particularly on coastal scrub farms. On odd occasions we have seen it as thick as Inkweed or Scotch Thistle. It is often grown as an ornamental plant, or as a curiosity on account of the inflated seed pods. It belongs to a dangerous family of plants, the *Asclepiadeæ,* and has been suspected of causing losses on one or two occasions. Stock, however, rarely touch it, or at least in sufficient quantities to cause trouble. The silky cotton which surmounts the seeds has no value for textile purposes, being too short and brittle, but the bark contains rather a strong fibre.

Grasses from South Burnett Identified.

Winter Fodder Club (Goomeri)—

The specimens have been determined as follows:—

(1) *Poa annua,* Annual Meadow Grass, a common European grass very common in Australia, mostly as a weed of cultivation, though in some localities it has invaded the ordinary pasture. It seems to be readily eaten by stock, and to be quite a useful winter and spring fodder, though not giving a great bulk of feed.

(2) *Bromus unioloides,* Prairie Grass, one of the best known winter fodders.

(3) *Setaria glauca,* Pigeon Grass. Very closely allied to the grasses grown in Queensland under the name of Hungarian Millet, Italian Millet, Panicum, &c.

(4) *Vulpia myurus,* Rat's Tail Fescue, a common weedy grass of no value as a fodder, so far as we know. It is quite common as a winter and spring weed in cultivation in Southern Queensland.

(5) *Bothriochloa intermedia,* a species of Blue Grass, and a valuable grass in the mixed native pasture.

South-Western Grasses Identified.

W.I.B.B. (Dirranbandi)—

The specimens of grasses have been determined as follows:—

(1) *Eriochloa* sp., Early Spring Grass. Species of *Eriochloa* are particularly palatable and nutritious. We do not think, on the whole, however, that they are particularly drought-resistant. Though they are common during the summer months, they often come in with an early spring and provide succulent forage when other feed is scarce.

(2) *Panicum decompositum,* one of the commonest grasses in the West; sometimes known as Barley Grass, at other times as Native Millet. It is quite a good native grass.

(3) *Bothriochloa intermedia* (?). Better material required to be sure. *B. intermedia* and its allies are quite good pasture grasses.

(4) *Chloris truncata,* a species of Windmill Grass, as far as can be told from the very scrappy specimen. All the Chloris grasses are particularly good. They are generally abundant in cleared brigalow country and always afford a bite for sheep, making good basal growth, even during the autumn and winter months.

(5) *Atriplex Muelleri,* a species of Saltbush. This, we think, is the commonest Saltbush in Queensland. It is, generally speaking, not favoured by stock, though they seem to take to it more readily when it is dying off.

We are not too sure of the botanical names of your common Roley-poleys or Bindy-eyes, as these names vary so in different localities.

Regarding plants to try in your district, the only grasses we can think of at the moment are Woolly Finger Grass (*Digitaria eriantha*) for your sandy country, and Blue Panic (*Panicum antidotale*). Seed of the latter is obtainable from Messrs. J. Jackson and Co., seedsmen, Brisbane.

The sensitive plant referred to by you is purely a herb or fodder plant for the coastal districts of the State, particularly the northern or more tropical portions.

Groundsel.

E.L.P. (Cooroy)—

Your specimen represents the Groundsel Bush (*Baccharis halimifolia*), a very common weed on the North Coast line, smothering much of the swampy country between the line and the coast. It is, however, by no means confined to such places, and sometimes makes its way on to the scrub farms of the Blackall Range, D'Aguilar Range, and other high lands, but does not seem to spread to the same extent in those places as it does in the coastal swamps.

The plant is spread by seeds, which are borne on the female plant in tremendous abundance. They are white and feathery, and are often picked on this account by passing motorists and others for decorative purposes, are blown about the country, and this is one way by which the plant is spread. As a species of Baccharis in the Argentine has been proved poisonous to stock; feeding tests were carried out some years ago at the Animal Health Station, Yeerongpilly, with the present plant. Animals were fed for about a fortnight, and we should say they ate during that period a good deal more of the plant than they would under normal conditions. Generally speaking, stock do not take very readily to the plant, although occasionally, for some reason or other, they will punish it rather severely. So far as the feeding tests at Yeerongpilly are concerned, though the animals were very emaciated at the end of the tests, they recovered when put on to ordinary feed; hence we do not think that the plant is as poisonous as many suppose, but it has little or no feeding value.

Wild Verbena. A Species of Bassia.

A.C.B. (Alton Downs)

(1) The plant from Alton Downs is *Verbena tenera,* a native of South America. It has for many years been a common naturalised weed about some of the western townships, particularly about Roma and Wallumbilla. About Roma it is one of the commonest town weeds, but does not seem to have spread, so far as we know, to any great extent into adjacent farms. It was, no doubt, originally introduced as a garden flower. This is the first specimen we have received from Central Queensland. It is generally called Wild Verbena.

(2) The thorny plant from Theodore is *Bassia tricuspis,* a species of Bassia that seems very much on the increase. As you know, the Galvanised Burr belongs to the same genus, but some allied species, including the present one, seem to be becoming almost as serious pests. Bindy-eye is a name sometimes applied to it, but this name is rather loosely applied to quite a number of burr plants in Queensland.

Water or Wild Millet.

L.M. (St. George)—

The specimen of grass is *Echinochloa Walteri,* sometimes called Water Millet or Wild Millet. It is a useful pasture grass closely allied to such well-known cultivated fodders as Japanese Millet or White Panicum, but is only suitable for growing in wet situations. The specimen was of great interest to us, as it is the first we have seen from inland parts, although the grass is moderately common on the coast.

Burr Trefoil.

D.F.K. (Tara)—

The specimen is the Burr Trefoil (*Medicago denticulata*), a very valuable winter and early spring fodder. It should do quite well in the Tara district in an average winter, and is worth every encouragement. Stock seem to prefer the plant when it is dying off rather than when it is green and luxuriant, but even the dried plant covered with its little seed-pods is quite nutritious. The burrs that follow the seed-pods are rather objectionable in the belly wool of sheep, but the good qualities, we think, outweigh the bad. Once it becomes established on a property it generally spreads of its own accord, but if you wanted to sow seed, this is stocked by some nurserymen and is listed by Arthur Yates and Co., Sussex street, Sydney, who would give you particulars as to price, &c. Seed should be sown preferably in April or May.

General Notes.

This Month's Cover Design.—An Acknowledgment.

For the photographic print used in this month's cover design we are indebted to the Editor of the "Courier-Mail," who has courteously permitted us to reproduce the striking farm scene at St. Lucia, which appeared originally in pages of his paper.

Staff Changes and Appointments.

Messrs. K. R. Hack (Nerang) and J. Wilson (Hunchy) have been appointed Growers' Representatives on the Banana Industry Protection Board.

Mr. P. T. Smith, of Kiamba, has been appointed an Honorary Inspector under the Diseases in Plants Acts.

Sub-Inspector J. Henderson, Townsville, has been appointed also an Inspector under the Slaughtering Act.

The Officer in Charge of Police, Oakey, has been appointed also an Acting Inspector of Stock.

The appointment of Mr. A. E. Adcock (caretaker of the Wambo Shire Council Dip at Dalby) as an Acting Inspector of Stock will be cancelled as from the 1st October next.

Mr. G. W. J. Agnew, of Gatton, has been appointed an Inspector under the Diseases in Plants Acts, Department of Agriculture and Stock.

Mr. D. F. Keith, Inspector of Dairies at Crow's Nest, has been appointed Grading Inspector, Department of Agriculture and Stock.

Mr. H. B. Ford, Inspector of Stock, Ravensbourne, has been appointed also an Inspector under the Slaughtering and Dairy Produce Acts.

The Officer in Charge of Police, Tully, has been appointed also an Acting Inspector of Stock.

Mr. A. F. S. Ohman, Government Veterinary Surgeon, Brisbane, has been transferred to Toowoomba.

Mr. S. C. Allan, Inspector of Stock, Crow's Nest, has been appointed also an Inspector under the Dairy Produce Acts.

Mr. G. Ollett, Secretary of the Marian Mill Suppliers' Committee, has been appointed Canegrowers' Representative on the Marian Local Sugar Cane Prices Board in place of Mr. G. H. R. Dark, deceased.

Constable J. A. Schick, Bedourie, has been appointed also an Inspector under the Slaughtering Act.

Mr. H. B. Carney, Clerk of Petty Sessions, Ingham, has been appointed Chairman of the Macknade and Victoria Local Sugar Cane Prices Boards in lieu of Mr. J. A. Murray, resigned; also an Agent of the Central Sugar Cane Prices Board for the purpose of making enquiries under Section 5 (2A) of the Regulation of Sugar Cane Prices Acts in regard to sales and leases of assigned lands.

Mr. M. R. Muller, Inspector under the Stock, Slaughtering, and Dairy Produce Acts, has been transferred from the Oxley Bacon Factory to Gladstone; and Mr. G. R. Sigley, Inspector of Stock, Slaughtering, and Dairying, from Gladstone to the Oxley Bacon Factory.

The Peanut Board.

The Peanut Board election for two growers' representatives for Districts Nos. 1 and 3 for a term of two years resulted as follows:—

District No. 1 (Nanango and Wienholt)—

Leslie Vivian Young (Wooroolin)	163 votes.
Norman James Christiansen (Wooroolin)	157 votes.

District No. 3 (Rest of Queensland except Central Queensland)—

Albert George Whiting (Atherton)	62 votes.
Daniel Macdonald (Biboohra)	3 votes.

Mr. Christiansen, the present member for District No. 1, has been replaced by Mr. Young; and Mr. Whiting has been re-elected for District No. 3 by a considerable majority.

Police Reserve at Marlborough a Sanctuary.

The Police Reserve at Marlborough has been declared a sanctuary under the Animals and Birds Acts. Native animals and birds will, in future, be protected on this reserve.

Rural Topics.

The Art of Advertising.

"I do not pretend to be an expert," said the Prince of Wales the other day at the annual dinner of the Advertising Association, "but I have studied the questions of salesmanship and advertising, not from statistics, but from any years of travel, not only in this country but throughout the world, hearing for myself and seeing for myself. Experience has taught me that just as unmined gold has no value, so are manufactured goods, hidden away in warehouses and factories, useless until made known and made desirable by the art of advertising." The Prince also expressed the opinion that advertising is more urgently needed to-day than ever, and that upon the efficiency with which it performs its task much of our prosperity must depend; and it was evident from his references to advertising methods that he has given the subject very close attention.

A Typical Bull's Head—Illawarra Breed Type.

In all dairy breeds a good deal of importance is attached to the head of the bull. Mr. A. M. Hunt, president of the Australian Illawarra Shorthorn Society, recently described what he considered should be a good standard head. It should be masculine and full of breed character, clean cut and well moulded; of medium length in proportion to size of animal. Forehead broad and slightly dished between the eyes, of medium length, well moulded, and narrowing a little below horns. The hair on the forehad either curly or rather long, but should be of good quality. The horns either short or of medium length, set well apart on crown of head, and of a waxy or creamy appearance, oval shaped at base, and of medium thickness, gradually tapering and continuing forward on a level with top of crown, and with a slightly upward or downward tendency at points, the latter preferred. Coarse, over-long, heavy or cocky horns objectionable. Full, clear, prominent eyes of a bluish tinge, and set well apart, and encircled by an orange-tinted skin, either free of hair or with very fine short hair. The face, from eye to muzzle, should be of good length, strong and well chiselled, and not dished, joining on to a clean, square, fairly broad, flesh-coloured muzzle. Mouth of medium size, lips not heavy, but nostrils well defined and open. Cheeks and jaws flat and fine, covered with shortish hair. Under-jaw well developed and fairly flush with mouth, with very little loose skin underneath. The ears of medium size set on level and with short silky hair, and plenty of secretion inside. When viewed from any angle the head and horns should harmonise with the body and give the appearance of masculine strength, vigour, yet refinement.

Value of Good Udders.

Mr. Cuthbert Nairn, of Sycamore Farm, Pennsylvania (U.S.A.), has a word to say in the "Ayrshire Digest" about the need for maintaining breed type:—

"I want a cow that has striking breed character, ample capacity, real dairy type, and quality throughout her entire make-up. By capacity, I mean those important parts of a cow that are responsible for her being able to produce efficiently. I haven't much use for a cow that is now a profitable producer.

"I have never seen a real cow that did not have plenty of digestive capacity and the ability to handle an abundance of feed.

"The udder is the most important part of the cow. A poor udder is about the worst fault that a cow can have. . .

"There are real advantages in having udders built right. Udders that are so built are protected from injuries that come to udders that hang down where they are easily struck or stepped upon. They are easier to keep clean. It is easier to make clean milk from them and there is no question but what they wear better. . .

"Some cows become worthless because of their undesirable hind legs, which should be nearly straight when viewed from the rear with the hocks squarely set. If a cow has the right kind of feet and legs she can stand long years on concrete. . .

"You will agree with me that it is a lot easier for the cow that is built right to produce efficiently year after year than the cow that is not properly made. . ."

Safeguarding the Cow—Her Economic Value.

In the course of an article in the Ayrshire Cattle Society's Journal on "Producing the Milk," A. D. Buchanan-Smith, Institute of Animal Genetics, University of Edinburgh, said:—

"If a cow has the inherited potentiality of 2,000 gallons per lactation, it would probably be enough to feed her so that she yields just rather under that. It would be positively dangerous to try to force her above her potential production. There can be no doubt that the chairman of the Milk Marketing Board was correct in questioning the advisability of forcing cows to their uttermost limits, and not merely squeezing, but positively extracting, by torture, the last ounce of milk from them. On no account should the method of feeding adopted be beyond the inherited capacity of the cow.

"The other point that emerges quite clearly is this: High milk production in one lactation is not enough. What is required is an inherited capacity for high yield, plus long life. Supposing we have a cow capable of giving 1,200 gallons. If we force her so that she gives 1,300 gallons, we would possibly put her off her legs and she would not live long. Accordingly, she should be fed for rather under her hereditary capacity, and we should hope to get a long life out of her. Attention to the feeding question, however, will not alone make a cow live a long time. Not all cows die a natural death. They get troubled with their udders, with their feet, with their legs, and with their reproductive organs. It is those troubles which cause a cow to be put out of the herd, and so shorten her life. It is the cow who has the hereditary capacity for withstanding these troubles that is the economic cow. A good, hard-wearing udder, good legs, good feet, the capacity to reproduce regularly, are subject both to nutrition and heredity. The two must work hand-in-hand, and of course there must be adequate control of disease.

"How, then can we measure the economic value of a cow? The mere yield of a single lactation is not a very reliable indication. It may indicate a bad cow, but it cannot reveal a good one. What is of prime importance is that the cow should have given a good yield for a long period. Therefore, when we talk about the 10,000-gallon cow, or hear the Americans talking about the 100,000-lb. cow, then we are hearing about valuable animals, especially if those high yields have been compiled by an average of 1,000 gallons per year over a period of ten years. There can be very little room for doubt that such cows are truly economic and remunerative to their owners. From a productive standpoint, that is the ideal cow of the Ayrshire breed, the four thousand pound butterfat cow."

Mange Cure.

We are frequently appealed to for a remedy for dogs affected with mange. We recommend the following, which we have found very effective in almost every case where it has been applied in time. Don't wait until the dog is hopelessly affected before commencing treatment.

Wash affected parts with soft soap and warm water an hour before applying.

Apply 1 dr. creosote, 1 dr. liquor of potassa, 12 drs. olive oil. Repeat twice weekly.

Wanton Destruction of Wild Birds.

Extract from the Annual Report of the Queensland Society for Prevention of Cruelty:—This is a matter about which the society has been much concerned, because we were aware of the extent to which the cruel destruction of harmless birds took plase, mostly at the hands of thoughtless school boys, and in some cases the sons of parents who subscribe to the society—yet they provide their sons with pea rifles and shanghais to go out shooting birds. Perhaps the mother bird of a nest of fledglings is maimed or killed, leaving the little family to die of starvation.

We have in the past endeavoured to stop or check this by appealing through the schools, but we only met with a small measure of success. Now, however, we are glad to learn that action is being taken by Mr. Bulcock, the Minister for Agriculture, and we are hopeful that before this report is in print, a proclamation will have been issued by the Government making the Greater Brisbane area one big sanctuary. At present there are nearly thirty different sanctuaries, which makes it impossible to check those breaking the law. But when this one sanctuary scheme becomes an accomplished fact, then any person found with a gun, pea rifle, shanghai, &c., within the area, will be committing an offence.

We heartily compliment the Government on its humane action.

Another phase of cruelty is involved in the many instances of trapping and traffic in birds that are purchased by no doubt well-meaning people, and then caged for the rest of their lives. Why do we do it? [The whole of the Greater Brisbane area has since been proclaimed a sanctuary for protected bird life.—ED.]

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

HOUSEKEEPING IN HARD TIMES.

SPEND YOUR MONEY WISELY AND ECONOMICALLY.

(*In writing this we are indebted to a booklet by Dr. Phyllis Cilento and to other kind friends who have made a special study of economical housekeeping. We write with special reference to conditions in Brisbane.*)

THERE are two reasons why so many children are poorly nourished—want of knowledge and want of pence. It is quite possible to give children as much as they want to eat and yet feed them so badly that they cannot be really healthy. These children are thin, undergrown, easily tired, slow at school, constantly suffer from colds and coughs, often develop diseased tonsils and adenoids, and have a poor chance of developing into healthy men and women.

The Right Feeding of Families.

The right feeding of families on relief wages is difficult; yet it is surprising how much can be done by a woman who is a good manager and has some knowledge of the values of foods. Everything depends on the housewife and the care and skill with which she spends the slender stream of shillings and pence which form the family income. It will help her very much if she makes use of the following hints:—

Do not live from hand to mouth. Think out carefully the week's rations of your family—what you will need and what you will pay for it.

Buy the food supplies yourself. Local cash shopping centres are cheap, and tram fares are more than saved by lessened cost and better quality. Watch the market prices and buy what is cheap and in season. Pay cash and you can buy where, how, and when you like.

Buy wisely. It is not the costly foods that are most valuable. The cheaper cuts of meat, if properly cooked, are just as nourishing as the more expensive. Liver, kidneys, heart, and sweetbread are more valuable foods than chops, steaks, and joints, and they are much cheaper.

Choose the fruit and vegetables that are plentiful and cheap. The best vegetables are those that you grow yourself. Even a few lettuces and tomatoes grown in tubs or tins are a great help. On a very small piece of ground you can grow enough vegetables to support a family, and save two or three shillings every week. Lettuces, silver beet, carrots, and tomatoes are the most valuable and easy to grow. If besides these you can grow cabbages, beans, peas, marrows, turnips, parsnips, and onions, you are well off indeed. Every backyard should grow a lemon tree and a few pawpaws, together with a choko vine. This applies specially to Brisbane and the coastal districts from Bundaberg southwards. With water laid-on it is easier, but even without this you can use the bath water, and in good seasons the rain will help you.

Do not waste your money on cooked or tinned foods, biscuits, rusks, or fancy breakfast foods. Wheatmeal is the best breakfast food, oatmeal comes next, and both are inexpensive. Both of them may be used for scones, cakes, and puddings; if flour alone is used, add some large spoonfuls of cooking bran.

The one thing of which you should always buy enough is milk. Every child under six should have one pint of milk daily; from six to fourteen half a pint is the least that can be advised; over fourteen a quarter of a pint should be the minimum.

Though dried skimmed milk is no substitute for milk, it may be used with butter or dripping in puddings. Condensed milk is half sugar and is never economical. Mixed, as it usually is, with much water, it is very poor nourishment.

Instead of puddings, give the children sometimes junket mixed with sliced or shredded uncooked fruit—apples, oranges, pineapple, papaw, tomatoes, &c.

Butter is the most valuable fat. Next to it comes dripping, which is cheaper. You should carefully save your own dripping. This will not be much, and you will probably need to buy some. Margarine is inferior to dripping and costs more.

Use sugar and golden syrup in moderation. Too much of them may possibly satisfy your children's hunger but leave them undernourished and unhealthy for want of better food. Home-made jam (cost of fruit, sugar, and fuel) is much cheaper than bought jam.

It is better to spend a penny or two on carbonate of soda and cream of tartar than to throw away money by buying self-raising flour. Wholemeal bread and flour cost more than they should. We, therefore, advise you to buy cooking bran (1½d. a lb.) to add to porridge, puddings, and scones; or it may be taken simply moistened with milk or water. The daily allowance is two heaped teaspoonfuls for each person. In a family of five 1 lb. should last twenty-five days.

Prepare the right quantities for each day, but never throw away food unless it is bad. "Leftovers" may be used in many ways. Sour milk can be made into scones and saves using cream of tartar. Porridge may be made into milk puddings. Stale bread and scones may be made into trifle, with junket or custard and jam, or they may be baked into rusks, or they may be fried. Crumbs are always useful for cooking. Pineapple peelings make a nice acid drink. Cold potatoes may be sliced for salads, made into soup or into scones. Outside lettuce leaves, turnip tops, and silver beet are as good as spinach. Bones and fishbones and trimmings of bones and fish are good for soup; so also is any water that drains away from cooked vegetables. Pea pods boiled soft and strained are a useful vegetable for soup.

Save fuel by arranging your meals so that several dishes may be cooked at the same time. Remember that raw fruits are better than cooked fruits. Well-washed lettuces with sliced tomatoes or shredded young carrots should sometimes replace cooked vegetables. Cold meat is better than twice-cooked meat (though that is good) if it is fresh, but it must not be kept over twenty-four hours in the summer.

If vegetables are grated or cut up small, they need less cooking.

Next month we will give some economical weekly diet sheets.

IN THE FARM KITCHEN.

PINEAPPLE RECIPES.

Pineapples can be used to give zest and variety to meals which have, perhaps, become a trifle monotonous.

Their valuable dietetic properties are becoming more and more widely recognised, and, as an article of diet for both adults and children, they are rapidly increasing in favour.

Pineapple Plain.

Pineapple served in its own shell is very attractive. Cut off the bottom of the pineapple at the point where the sides begin to narrow downwards, and at the point where the sides begin to narrow upwards cut off the top. Take a very long sharp knife (a saw-knife is best) and detach the whole of the rest of the skin in one piece. Slip it off and cut the pineapple into round slices, without allowing them to fall apart. Stand the shell upright and very carefully replace the slices. Keep any juice, add to it a little liqueur, and serve separately. When shredding pineapple, the easiest way is to cut the pineapple in half, and with a stainless or silver knife chop and shred it within the skin before scooping into a dish. It is thus possible to get every bit of fruit and juice, leaving only the core, skin, and eyes behind.

Pineapple Dessert.

Peel a ripe pineapple and carefully take out the core with a silver knife. Pour into the cavity some sweet white wine and let it stand for twelve hours. Cut in slices and serve with caster sugar.

Pineapple Slices.

Take some peeled and cored pineapple slices and stew them in a thin syrup flavoured with rum. Cut slices of stale plain cake the same size as the pineapple and fry them in butter. Dust over with caster sugar, arrange them alternately on a dish with the pineapple and pour over it all the syrup and serve hot.

Pineapple Cup.

Squeeze the juice from a large pineapple and add to it a breakfastcupful of well-made barley-water and a wineglass of Kirsch. Let it stand for half an hour and add soda-water if liked.

Pineapple Salad.

Mix 1 cup tart chopped pineapple with a shredded grapefruit and half cup chopped nuts or celery. Add fresh or preserved cherries and serve on lettuce with mayonnaise dressing.

Pineapple Soup.

Take 2 tablespoons sago, 1 pint water, 1 stick cinnamon, 1 cupful chopped raisins, sugar to taste, cupful pineapple, juice half lemon, pieces of chopped pineapple. Put the sago in a pint of water and let it cook in a double saucepan with the cinnamon until transparent. Add the chopped and seeded raisins, sugar, pineapple, and lemon juice. Serve in glasses very cold with small pieces of pineapple floating in it. (A delightful dish for luncheon on a hot day.)

Pineapple Cream.

Take a large ripe pineapple, cut it in half, and shred all the pulp. Press half of it through a sieve, add to it the juice from the other half, and make it hot. Dissolve in it ½-oz. gelatine, add 3-oz. caster sugar and the rest of the shredded pineapple. Whip half pint of cream until stiff, and when the pineapple mixture is cool, stir together and keep stirring gently until it begins to set. Pour into a mould.

Pineapple Fritters.

Prepare the pineapple in advance by peeling, coring, and cutting it into medium slices. (The slices may be cut in half or left in rounds.) Sprinkle well with sugar, pour over them a wineglass of brandy if liked and let them stand for three hours. Make a thick batter by putting 6 tablespoons sifted flour into a basin with a pinch of salt, and adding to it yolks of 2 eggs and quarter pint of cold milk. Mix until very smooth, then add the whites of 3 eggs which have been beaten to a stiff froth. Dip each piece of pineapple into the batter and fry in boiling lard until a nice golden brown. Dredge well with caster sugar.

Pineapple Savouries.

(1.) Take a slice of pineapple, one-third of an inch in thickness, peel and core it, and cut into small cubes. Take some salmon, mash it up finely with seasoning and a dash of mayonnaise. Arrange a little on each cube of pineapple, garnish with chopped mint or capers, and place on each piece a toothpick for handling it. Arrange in a lettuce leaf or in paper cases.

(2.) Take cubes of pineapple, as in the previous recipe, dip them in flour seasoned with pepper and salt, and fry them in hot bacon fat. Fry also some narrow strips of bacon, and serve with pineapple on a fried crouton.

Pineapple Cake.

Take a round or square cake-tin and butter it very liberally. Put a thick coating of brown sugar and some more small pieces of butter, then half cup pineapple cut into small pieces. Pour in a plain Madeira cake mixture and cook in the usual way. Turn out when cooked, and, when cold, serve with whipped cream.

Pineapple Snow.

Take a small ripe pineapple, cut in half and shred as directed. Place in a saucepan with half cup sugar, and cook for a few minutes. Thicken with 1 dessert-spoon of arrowroot mixed with a little water. When thick remove from fire, and, when cold, fold in the whites of 2 eggs which have been beaten to a very stiff froth. Place in ice chest to become thoroughly cold and serve with custard made from the yolks of the eggs.

Pineapple Chutney.

Take 4 lb. unripe pineapple (peeled and cut into pieces), 1 lb. sultanas, 1 table-spoon green ginger, 1 oz. garlic, 1 lb. onions, 2 oz. salt, 1 oz. mustard-seed, 2 bottles vinegar, half tin golden syrup. Sprinkle the pineapple with salt overnight, drain, put it into the vinegar, and simmer over the fire for half an hour. Add all the other ingredients except the golden syrup, allow to cook slowly for another hour, add the syrup, and continue to cook for another half hour. Put into small jars and cork down when cold.

Crystallised Pineapple.

Take pineapples which are ripe, but not overripe. Peel them and cut into slices, taking out the core. Weigh the fruit and allow equal weight in sugar. Place in a dish and sprinkle them with part of the sugar. Leave for twenty-four hours, take the juice from the fruit, the remainder of the sugar, and quarter pint water to each pound of sugar. Boil gently for ten minutes, put in the pineapple, and boil two minutes. Turn all into clean dish, leave for two days, then boil the syrup again and pour it over the fruit. Next day boil up the syrup and, once more, when boiling, put in the fruit and boil for five minutes. Let stand again in the syrup for twenty-four hours, then spread on trays to dry, either in the sun or in a cool oven. When partly dry sprinkle with sugar and keep turning until quite dry. Pack between layers of paper.

AN ANT-PROOF DEVICE.

Here is an idea for keeping ants from climbing the legs of the safe, table, &c., in search of food. The device is inexpensively constructed, and when finished will look quite tidy and keep in good working order for a very long time without further

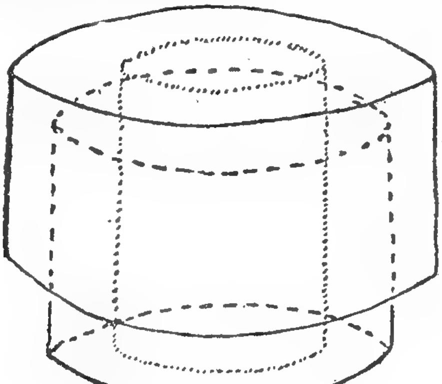

Plate 222.

attention. The materials required for each preventer are: One round piece of wood $1\frac{1}{2}$ inches in diameter and 2 inches long, one round tin $2\frac{1}{2}$ inches by $1\frac{1}{2}$ inches, one round tin $3\frac{1}{2}$ inches long by $1\frac{1}{2}$ inches deep, a few strong tacks, and a quantity of light cup grease.

The round block of wood must be squarely cut off on each end and is tacked to the bottom of the smaller tin in the centre. There will now be at least half-an-inch clearance all round the block of wood, and it will project half-an-inch above the top of the tin. The grease is to go in the space round the block, but before filling in the grease it is advisable to solder the heads of the tacks over to prevent leakage, which may occur on a hot day. The larger tin is fitted over the top of the wood and tacked in place. This top tin could be left off, but without it the baffler would not look finished, and would not be as effective, for the top cover keeps the dust from settling on the grease. The measurements given above are ideal, but may be varied to suit the materials at hand; but at all times there should be sufficient clearance so that the ants cannot bridge across.

A BUTTER COOLER.

A useful butter cooler to hang on a verandah can be made from a kerosene tin, cut as shown in Fig. 1 in the illustration, allowing 2 in. for the roll. On one side allow the full height of the tin; on the opposite side cut to 5 in., and slope the remaining sides. Place a $\frac{1}{4}$-in. iron rod along the edge, grip with a footprint wrench or pliers, and roll downwards till the dotted line is reached (BB in Fig. 2). Treat

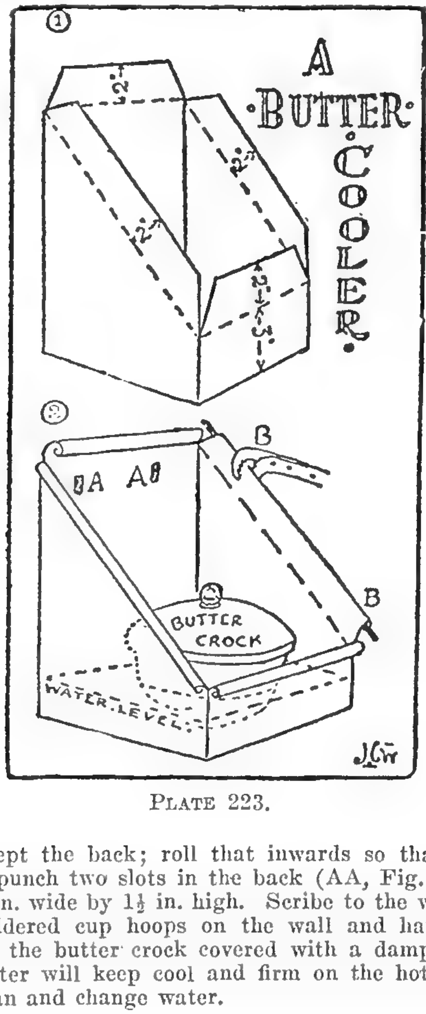

Plate 223.

all sides the same except the back; roll that inwards so that the tin will lie flat against the wall, then punch two slots in the back (AA, Fig. 2) with a screwdriver or cold chisel, about $\frac{1}{2}$-in. wide by $1\frac{1}{2}$ in. high. Scribe to the wall with a pencil, then screw two square-shouldered cup hoops on the wall and hang on. Put in about 2 in. of water; put in the butter crock covered with a damp cloth. If hung in a draughty place the butter will keep cool and firm on the hottest days, and it only needs unhooking to clean and change water.

FERTILIZERS FOR THE HOME GARDEN.

FOR the maintenance of fertility the city gardener has to place his chief dependence on chemical fertilizers, and the grower who lacks information as to the plant food content of his soil, and who desires to grow a wide range of crops of whose requirements he knows little, should play safe by using a high-grade "complete" fertilizer, and give a liberal application. Though he applies more than the plants actually require, the increased cost is so slight that the assurance of having enough is worth the additional expense.

A complete fertilizer is one supplying nitrogen, phosphorus, and potash in forms readily available to plants. A generally applicable complete fertilizer for home garden use consists of a mixture of dried blood, superphosphate and sulphate or chloride of potash. These substances in the proportions by weight of 3, 4, and 1 respectively give a 5-11-6 fertilizer, or one containing 5 per cent. nitrogen, 11 per cent. phosphoric acid, and 6 per cent. oxide of potash. On light-textured soils potash could be increased by using the same substances in the proportions of 2, 3, and 1, when a 4-11-8 fertilizer would be obtained.

Dried blood has many advantages as a source of nitrogen. It does not damage seeds or seedling roots, becomes available when the root system is developing, and is therefore not lost. It is a useful basal form of nitrogen application, carrying plants up to the stage where it may be advantageous to apply forcing soluble nitrogenous fertilizers.

Sulphate of ammonia may be used in place of dried blood in the complete mixture, but should be used in two-thirds the quantity. The use of sulphate of ammonia results in loss of lime from soils, and in time develops strong acidity. These harmful effects are easily overcome by liming, but it is not advisable to use this fertilizer on acid, lime-deficient soils.

The tendency in home gardens is to use quantities of manure without the application of potash and phosphate, and results in a bad nutrient balance, which accounts for the frequent reports of plants producing excessive vegetative growth, with poor flower, fruit, or tuber production. Under such conditions the addition of a mixture of four parts of superphosphate and one of sulphate or chloride of potash would result in a better nutrient balance.

For crops such as lettuce, cauliflower, cabbage, Brussels sprouts, spinach, and celery, where vigorous growth must be maintained, liquid fertilizers can be applied when the plants are well established. The following flowers, provided a complete fertilizer has been used initially, have been found to respond to nitrogenous top-dressing:—Dahlia, chrysanthemum, calendula, Iceland poppy, sweet pea, primula, &c. The soil should be moist before the application of liquid fertilizers.

The most efficient forms of nitrogen for liquid applications are nitrate of potash, nitrate of soda, or a mixture of these salts, and nitrate of lime. Sulphate of ammonia, phosphate of ammonia, or a complete liquid fertilizer consisting of nitrate of potash and superphosphate may be used. These substances are soluble in water (superphosphate will leave a considerable residue) and can be dissolved at the rate of 1 to 2 oz. per gallon, and the solution run along the rows from a water-can with the sprinkler removed, or applied with a measure in the case of larger, spaced plants.

If the liquid comes in contact with the leaves, these may be hosed down after the application has been made, to obviate the possibility of injury.

The practice of broadcasting fertilizers is wasteful, since much of it will not come within the absorbing range of roots. When seeds are planted in drills, these should be opened up several inches broad at the bottom and from 1 to 3 inches deeper than the seed is to be placed. The fertilizer is then distributed along the bottom of the row, at the rate of an ounce or two to the yard, the drill filled in to the desired depth, and the planting made.

With large growing plants that are spaced, such as tomatoes, cabbages, and potatoes, a hole a foot in diameter and several inches deep can be made with a spade, and a small handful of fertilizer scattered in the hole before filling in and planting above the fertilizer. Fertilizers for potatoes should be slightly below and in a ring about the tuber, rather than directly beneath it.

Orchard Notes for November.

THE COASTAL DISTRICTS.

NOVEMBER is somewhat of a slack month for fruit in the coastal districts, as the citrus crop, excepting a few Valencia Late oranges, off-season lemons, and a few lines, is over. Pineapples are also scarce, as the late spring crop is finished, and there are only comparatively few off-season fruits ripening. The main summer crop of fruit in the principal producing districts is only in the flowering stage, though that in the more tropical parts is ready for marketing. It is also a slack month for bananas, as the summer fruit is not yet fully developed, and the bunches that make their appearance are usually poor. They have been slow in developing on account of the comparatively cool weather of winter and early spring, when the suckers were more or less at a standstill. Young suckers should, however, be making vigorous growth now, and the plantation will require constant attention to prevent the stools being overcrowded with too many suckers. Keep the land well worked and free from weeds of all kinds, as good growth now means good bunches in the autumn and early winter. Where there is a danger of the soil washing badly with heavy rain, rows of Mauritius, velvet, or other suitable beans should be planted at right angles to the fall of the land, as the growth they make will tend to hold the soil, and thus save any from being washed away. When planting beans of any kind, either to prevent washing or for green manuring, don't forget to manure them, as thereby you will get a much greater yield, and as none of the manure is removed from the soil, as the crop is allowed to lie and rot on the ground, it is all made use of eventually by the permanent crop.

A good all-round manure for a bean crop is a mixture of 1 cwt. of sulphate of potash and 4 cwt. of basic superphosphate or finely ground phosphatic rock to the acre, and if the soil is deficient in lime a dressing of not less than half a ton to the acre will be found very beneficial, as all leguminous plants require lime to yield their maximum return both of haulm and pulse. The pineapple plantations require to be kept in a state of thorough tilth, and no weeds must on any account be allowed to grow. If blady grass makes its appearance it must be stamped out, as once it gets established in the rows it is only a short time before it takes control, and the plantation is ruined, so that it can only be brought back into profit by taking out the pines, killing the blady grass, and, after thoroughly and deeply working the land, manuring it and replanting.

The planting of pineapples and bananas can be continued throughout the month, taking care to see that the land is properly prepared and that the advice given in previous monthly notes is followed. Young papaw plants that have been raised in the seed bed can be set out now, as also can young passion fruit. Citrus orchards require to be well looked after; the ground must be kept in a state of thorough tilth, and if the trees show the slightest sign of distress, owing to lack of moisture in the soil, they must be given a thorough irrigation if water is available for this purpose. The trees should be carefully examined from time to time, so as to note when young scale insects of any kind are hatching out, and when this is noted they should be sprayed with a weak emulsion of a miscible oil consisting of one part of oil in forty parts of emulsion, as this is quite strong enough to kill any young scales before they develop their protective covering. As stated in these notes previously, no oil sprays should be used when the trees are suffering from lack of moisture, as they are then likely to do more damage than good to citrus trees. If scale insects are very bad, and it is important that the trees are sprayed, a weak lime-sulphur spray, or even a soap and tobacco or weak resin wash, will kill the young scales as they hatch out. In the earlier districts a keen lookout must be kept for the first appearance of the mites, which are the direct cause of the darkening of the skin of the fruit known as "Maori." The first indication of the trouble is that when the sun is shining on the young fruit it appears to be covered with a grey dust, and if the fruit is examined with a good lens, it will be seen to be covered with large numbers of small yellowish slug-like insects which are living on the skin. Spraying with sodium of potassium sulphide washes, as recommended by the Department, or with a weak solution of lime-sulphur, will destroy these insects and prevent the fruit from turning black. Borers of all kinds should be looked for and destroyed wherever found. Water sprouts, if not already removed, should be cut away. Vines will require careful attention, and the vineyard should be kept in a state of thorough cultivation. Spraying for downy mildew and black spot should be continued, if necessary, as well as sulphuring to prevent oidium.

Fruit fly must be systematically fought whenever seen, and special care must be taken to gather and destroy any early ripening peaches or other fruit that may be

infested. If this is done systematically by all growers, as provided by the Diseases in Plants Acts, there will be many less flies to attack the later crops of mangoes and other fruits.

Leaf-eating insects of all kinds should be systematically fought wherever seen, by spraying with arsenate of lead, and potatoes and tomatoes should be sprayed with a combined spray consisting of Bordeaux or Burgundy mixture and arsenate of lead, so that diseases such as early blight and Irish blight may be prevented and leaf-eating insects, which frequently cause very heavy losses to these crops, be destroyed.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

KEEP the orchards and vineyards in a thorough state of cultivation, so as to keep down all weed growth and conserve moisture in the soil. This is important, as if a long spell of dry weather sets in, the crop of summer fruit will suffer severely from the lack of moisture. Citrus trees should be irrigated where necessary, and the land kept in a state of perfect tilth. Spraying for codlin moth should be continued, and all pip fruit trees must be bandaged at the beginning of the month; further, the bandages must be examined at frequent intervals and all larvæ contained in them destroyed. The neglect to spray thoroughly and to attend to the bandages properly is responsible for the increase in this serious pest in the Granite Belt, and growers are warned that they must pay more attention to the destruction of this pest if they wish to grow pip fruit profitably. Fruit fly may make its appearance in the cherry crop; if so, every effort should be made to stamp out the infestation at once, as, unless this is done, and if the fly is allowed to breed unchecked, the later ripening crops of plums, peaches, apples, pears, apricots, and Japanese plums are bound to become more or less badly infested. Combined action must be taken to combat this the most serious pest of the Granite Belt, and growers must realise that, unless they take this action and see that careless growers do not breed the fly wholesale, they will never keep it in check, and it will always be a very heavy tax on their industry. Rutherglen bug is another serious pest in this district, and is propagated by the million by careless orchardists. The best remedy for this pest is to keep the orchard clean and free from weeds. Brown rot in fruit should be watched for carefully, and, on its first appearance in a district, all ripening fruit should be sprayed with the sodium sulphide wash.

All kinds of leaf-eating insects should be kept in check by spraying with arsenate of lead, and all grape vines, potatoes, and tomatoes should be kept sprayed with Bordeaux or Burgundy mixture, the former for black spot and downy mildew, and the latter for early and late (Irish) blight.

Farm Notes for November.

FIELD.—Farmers are commencing to realise that quick-maturing wheats which possess a degree of rust resistance are more dependable than the slow-growing and often rust-susceptible kinds, which are gradually giving place to these and mid-season varieties.

Growers are advised to make every preparation to work up the surface of the ground immediately after the removal of their crops, so that the soil may be put into good condition to receive any rain which falls, the conservation of which is the best guarantee for the success of the next succeeding crop. Such initial preparation also encourages the early growth of all foreign and weed seeds, and permits of their eradication by the implements used to produce the desired soil mulch. In such manner paddocks are kept clean and the purity of crops is maintained. The careful preparation of areas intended for maize-planting cannot be too strongly impressed upon growers. Deep and thorough ploughing, followed by cross-ploughing and subsequent cultivation of the soil, must precede sowing if success would be attained; and all efforts must be concentrated to obtain a good surface mulch. Failure to follow up the subsequent sowings by harrowing prior to the appearance of the young plant conduces to weed growths and very often entails, by neglect of this operation, subsequent hand-hoeing between the plants in the drills. Harrowing should be discontinued before the plant breaks through the surface, otherwise damage will accrue to the tender shoots of the young plants. When the young maize plant has hardened up it may, with advantage, be lightly harrowed in the direction of the drills, but such practice must discontinue once the plant has attained a height

of 6 inches. Close cultivation by inter-row cultivation implements is necessary after every shower to conserve moisture and to prevent weed growth, care being taken to ensure each cultivation being shallower than the preceding one, and so prevent damage to the root system of the plant, which is extensive. Inter-row cultivation should cease with the advent of the cob on the plant; and, if proper attention has been given to the crop, it should, at this period, be unnecessary. Where crops are planted on the check-row principle, inter-row cultivation is facilitated, and more even crops result.

The French millets (red and white), owing to their rapid maturing qualities, form excellent intermediate or supplementary crops, and are suitable for present sowing. Their value for fodder and seed purposes is worthy of more general recognition at the hands of the average farmer.

Past dry periods have impressed upon us the necessity of providing during good seasons against the return of less favourable ones, and in this connection the cultivation of quick-growing fodder plants appeals to us. Many varieties of useful classes of fodder can be cultivated over a large portion of this State; chief of which, perhaps, are the sorghum family for grain and fodder purposes. Of the latter, Sudan grass has much to commend it, and is fast becoming one of the most favoured by stockowners. Grain sorghums, of which Feterita, Red Kaffir, and the various Milos are examples, should occupy a more prominent position for purposes of horse and pig feeding, and are particularly suited to those localities which are unsuitable for maize production. Some varieties of sorghums have strong frost-resisting qualities, and lend themselves to those localities where provision for some form of succulent fodder is necessary during the winter months.

Crown Land for Grazing Selection.

WEELAMURRA RESUMPTION.

CUNNAMULLA LAND AGENT'S DISTRICT.

THE eastern end of the holding, together with an adjoining surrendered selection, comprising in all about 29,000 acres of good mulga country, will be opened for Grazing Homestead selection at the Land Office, Cunnamulla, on Monday, 12th November.

The term of lease will be twenty-eight years, and the annual rental 2d. per acre for the first seven years of the term.

The area is situated about fifty-five miles south-easterly from Cunnamulla, and comprises partly nice open plains, coolibah, gilgai, and sandy mulga and pine country interspersed with box. Good herbage is available in favourable seasons, and the country is fattening.

The country is well watered by bore drains from an adjoining selection, and present supplies are sufficient.

The improvements, embracing homestead and outbuildings, fencing, yards, and bore drains are valued at £1,034.

The selection will require to be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years, and proof must be furnished of the financial standing and pastoral or land experience of the applicants.

The selection must be enclosed with a rabbit-proof netting fence during the first three years of the term.

Free lithographs and full particulars may be obtained from the Land Agent, Cunnamulla; the Land Settlement Inquiry Office, Brisbane; and the Government Intelligence Bureaux, Sydney and Melbourne.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF AUGUST, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING AUGUST, 1934, AND 1933, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Aug.	No. of Years' Records.	Aug., 1934.	Aug., 1933.
North Coast.	In.		In.	In.
Atherton	0·89	33	0·29	2·71
Cairns	1·75	52	0·53	2·77
Cardwell	1·25	62	1·96	1·83
Cooktown	1·23	58	0·23	1·02
Herberton	0·65	48	0·37	1·22
Ingham	1·43	42	1·29	1·93
Innisfail	4·93	53	1·56	6·18
Mossman Mill ..	1·42	21	0·87	4·30
Townsville	0·52	63	0·27	1·84
Central Coast.				
Ayr	0·58	47	0·22	1·88
Bowen	0·66	63	0·59	2·18
Charters Towers ..	0·54	52	0·62	0·37
Mackay	1·05	63	0·42	1·93
Proserpine	1·56	31	1·01	3·87
St. Lawrence ..	0·82	63	..	0·58
South Coast.				
Biggenden	1·09	35	1·31	2·41
Bundaberg	1·28	51	1·64	1·58
Brisbane	1·99	83	1·26	0·90
Caboolture	1·53	47	1·63	1·20
Childers	1·21	39	1·59	1·69
Crohamhurst ..	2·18	41	1·20	1·40
Esk	1·48	47	1·56	0·96
Gayndah	1·15	63	1·80	1·46
Gympie	1·72	64	1·42	1·25
Kilkivan	1·45	55	0·98	1·45
Maryborough ..	1·70	63	2·02	1·80
Nambour	1·83	38	1·59	1·37
Nanango	1·32	52	2·23	1·58
Rockhampton ..	0·84	63	0·46	0·88
Woodford	1·69	47	0·47	1·40

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Aug.	No. of Years' Records.	Aug., 1934.	Aug., 1933.
Central Highlands.	In.		In.	In.
Clermont	0·70	63	..	0·66
Gindie	0·66	35	..	1·02
Springsure ..	1·06	65	0·16	1·59
Darling Downs.				
Dalby	1·20	64	0·95	1·31
Emu Vale ..	1·10	38	0·51	0·60
Hermitage ..	1·19	28	..	0·38
Jimbour	1·16	46	1·23	1·24
Miles	1·13	49	0·26	1·52
Stanthorpe	1·77	61	2·46	1·15
Toowoomba ..	1·65	62	1·40	1·50
Warwick	1·46	69	0·85	0·61
Maranoa.				
Roma	0·93	60	0·07	1·21
State Farms, &c.				
Bungeworgorai ..	0·76	20	0·21	0·98
Gatton College ..	1·13	35	1·01	0·73
Kairi	0·94	20	0·30	2·45
Mackay Sugar Experiment Station	0·90	37	0·27	1·66

GEORGE G. BOND, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—AUGUST, 1934.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·99	79	62	82	18, 19, 20, 24, 25, 27, 28, 29,	51	14	23	2
Herberton	..	73	49	80	15	35	7	37	2
Rockhampton	30·12	77	52	84	15	40	8	46	5
Brisbane	30·13	70	51	77	14	41	5	126	4
Darling Downs.									
Dalby	30·13	68	42	78	28	30	5, 7	95	3
Stanthorpe	..	60	36	72	28	22	6	246	11
Toowoomba	..	63	43	72	14	32	7, 8	140	8
Mid-Interior.									
Georgetown	30·02	84	55	91	26	44	7	Nil	..
Longreach	30·12	76	45	90	26	35	6	Nil	..
Mitchell	30·12	71	40	82	26	28	6	75	2
Western.									
Burketown	30·05	82	55	90	18, 19	48	14, 23	Nil	..
Boulia	30·11	76	47	94	26	38	23	9	2
Thargomindah	30·10	69	46	89	27	37	2, 4, 6	99	2

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	October, 1934.		November, 1934.		MOONRISE. Oct., 1934.	MOONRISE. Nov. 1934.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	5·33	5·51	5·3	6·9	12·50	1·16
2	5·32	5·52	5·2	6·10	1·35	1·46
3	5·31	5·53	5·2	6·11	2·13	2·15
4	5·29	5·54	5·1	6·11	2·45	2·45
5	5·28	5·55	5·0	6·12	3·17	3·16
6	5·27	5·56	5·0	6·12	3·46	3·49
7	5·26	5·56	4·59	6·13	4·15	4·26
8	5·25	5·57	4·58	6·14	4·46	5·8
9	5·24	5·57	4·57	6·15	5·17	5·58
10	5·23	5·57	4·56	6·16	5·31	6·56
11	5·22	5·58	4·56	6·16	6·30	8 0
12	5·21	5·58	4·55	6·17	7·14	9·5
13	5·20	5·58	4·55	6·18	8·6	10·14
14	5·19	5·59	4·54	6·19	9·4	11·19
						p.m.
15	5·18	5·59	4·54	6·20	10·9	12·23
16	5·17	5·59	4·53	6·21	11·13	1·25
					p.m.	
17	5·16	6·0	4·52	6·21	12·21	2·26
18	5·15	6·0	4·52	6·22	1 28	3·28
19	5·14	6·1	4·52	6·23	2·32	4·30
20	5·12	6·2	4·51	6·24	3·38	5·34
21	5·11	6·2	4·51	6·25	4·38	6·35
22	5·10	6·3	4·51	6·26	5·40	7·35
23	5·9	6·3	4·50	6·27	6·46	8·30
24	5·8	6·4	4·50	6·28	7·52	9·20
25	5·7	6·5	4·50	6·28	8·59	10·4
26	5·6	6·6	4·50	6·29	9·48	10·41
27	5·6	6·6	4·50	6 29	10·42	11·16
28	5·5	6·7	4·49	6·30	11·28	11·47
29	5.4	6.7	4·49	6·30	a.m.	a.m.
30	5·4	6·8	4·49	6·31	12·10	12·14
31	5·3	6·9			12·45	

Phases of the Moon, Occultations, &c.

9 Oct.,	● New Moon	1 5 a.m.
16 ,,	☾ First Quarter	5 29 a.m.
23 ,,	○ Full Moon	1 1 a.m.
30 ,,	☽ Last Quarter	6 22 p.m.

Apogee, 3rd October, at 7.54 a.m.
Perigee, 19th October, at 12.18 a.m.
Apogee, 31st October, at 3.24 a.m.

When the Sun sets on the 10th Mercury, being at its greatest eastern elongation, 25 degrees, will be well above the western horizon (which it will reach 1 hour 43 minutes later) at a point 11½ degree further south at 4 o'clock next morning, Mercury will be only 2 degrees north of the Moon, so that when the Moon rises 2½ hours later the distance between the two will be between 3 and 4 degrees.

Jupiter, which may be said to have been an evening star, in Virgo, since early in April, will be lost to sight in October, as it will be in a line with the Sun on the 27th. It will then be on the far side of its orbit and at a distance of more than 550 million miles from the Earth.

Saturn, which may also be said to have been an evening star since June, keeping very near the border line of Capricornus and Aquarius, but with a slight retrograde motion, from Right Ascension 22·3 to 21·37, will become stationary on the 27th, and then again move very slowly eastward, without, however, getting so far as it was in June.

The brilliant planets Venus and Jupiter will be in very close conjunction on 2nd November, when the apparent distance between them will be only 3 minutes. This would form a very interesting spectacle if it were not that they will seem to be so close to the Sun as to be within 3 degrees of it.

The path of the Moon will be—in Gemini on the 2nd and 3rd of October; in Leo from 3rd to 6th; in Virgo from 7th to 10th; in Libra on the 11th; in Scorpio 12th; in Orphineus 13th; in Sagittarius 14th to 16th; in Capricornus 16th to 18th; in Aquarius 18th to 20th; in Pisces 20th to 22nd; in Aries 23rd and 24th; in Taurus 25th and 26th; in Gemini 27th to 29th; in Cancer 30th, and in Leo on the 31st.

Mercury sets at 7.39 p.m., 1 hour 48 minutes after the Sun on the 1st; on the 15th it sets at 7.44 p.m., 1 hour 55 minutes after it.

Venus rises only 32 minutes beforethe Sun on the 1st, and only 20 minutes before it on the 15th.

Mars rises at 3.19 a.m. on the 1st, and at 2.51 a.m. on the 15th; Jupiter sets at 7.24 p.m. on the 1st, and at 6.43 p.m. on the 15th. Saturn sets at 3.35 a.m. on the 1st, and at 2.38 a.m. on the 15th.

7 Nov.	● New Moon	2 44 p.m
14 ,,	☾ First Quarter	12 39 p.m.
21 ,,	○ Full Moon	2 26 p.m.
29 ,,	☽ Last Quarter	3 59 p.m.

Perigee, 12th November, at 10.54 p.m.
Apogee, 28th November, at 12.18 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

ANNUAL RATES OF SUBSCRIPTION.

Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling.** Members of Agricultural Societies, **Five Shillings,** including postage. General Public, **Ten Shillings,** including postage.

QUEENSLAND AGRICULTURAL JOURNAL

VOL XLII. 1 NOVEMBER, 1934. PART 5.

Event and Comment.

Development of Agriculture in Queensland.

IN the course of his reply in the debate on Supply in the Legislative Assembly, the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, said—

> Perhaps the most gratifying feature of the protracted debate on this vote is the eulogy that has been paid by all hon. members on both sides of the Committee to the very excellent staff in the Department of Agriculture and Stock. As the Minister in charge of that department, I very heartily corroborate everything that has been said. Of course, there is nothing spectacular about the work that our officers are doing. The ordinary layman does not realise the research work that is being proceeded with, for instance. Such words as plant pathologist, entomologist, and agrostologist are to them but names. The men engaged in this particular phase of research are modesty personified, certainly not through any lack of capacity. They are infrequently brought in contact with the public. They are men of a calibre which ranks very highly in the scientific agricultural world of Australia. They are men of whom Queensland may well be proud. There is certainly a more generous recognition to-day of the work of these men in Queensland than perhaps was ever the case before. That corresponds with the alteration that is taking place in the public outlook in regard to primary production. There is not a member of this

Committee who does not remember the time when the average primary producer was referred to in such terms as "cocky," "clodhopper," "wayback," and "rustic." Terms of that description carry some suggestion of a sneer, but fortunately they are falling into disuse. The economic factors of our national life are causing the public generally to view the farmer in his proper perspective, and while we know that that attitude has had little association with the social phases of agriculture, as a department, yet it is to the material good of the whole of the community that this change has taken place.

I have detected a new note creeping into the debate on this occasion, a note that I welcome, a note that finds a ready response in my own mind, that note being that with but few exceptions there is a more generous recognition on the part of members of the value of science in agriculture. Two hon. members suggested that the development of agriculture to-day was entirely a scientific matter. I agree, because if we review the question generally we find that practically every country in the world that has effected a progressive agricultural policy has solved the cultural problem within its own territory. The main problem is not, therefore, one of production, but of distribution. But associated with that question of production is always the question of the reduction of overhead expenditure by the application of new methods. It is true that the old maxim that was generally accepted, unfortunately, by the farming community a generation or so ago, "What was good enough for my father is good enough for me," has now been reversed, so that the average young progressive farmer realises the dependence on science of agriculture, the alliance between cultural operations and economic facts as apart from economic theories. These things have been recognised by the younger generation, who realise that agriculture will not reach its proper social, political, or economic plane until such time as there is a recognition by all sections of the community of their interdependence. The eulogy that has been accorded to the science officers of my department is very gratifying.

Wood Taint in Butter.

REFERRING to the question of wood taint which was raised in the course of the debate, Mr. Bulcock said:—

Quite frequently Queensland butter has been prejudiced in London, not in consequence of the actual incidence of wood taint, but because of the suggestion that it is there. It is doubtful whether wood taint has ever been a problem so far as Queensland butter overseas is concerned; but it is true that implication has frequently been made, and the suggestion that Queensland butters have wood taint is the reason why this product has not succeeded as well on the London market as it would have succeeded had that not been the case. The Commonwealth Government insist on all butter-boxes being sprayed. The matter is beyond our control. I believe the dairying industry generally is antagonistic to this Commonwealth regulation; but the Commonwealth controls exports, and so long as the Commonwealth controls exports—and that, of course, will be as long as there is a Commonwealth—then we shall have to subscribe to the regulations laid down. If we do not agree with the principle, we at least have to acquiesce in it.

Pasture Improvement.

MR. Bulcock then went on to speak of the work of his department in pasture improvement, and remarked:—

The hon. member for Cooroora (Mr. Harry F. Walker) raised the question of pasture improvement. Personally, if I were asked what I could eliminate from my department and if there had to be a progressive elimination, the last thing eliminated would be our work of pasture improvement. At this juncture pasture improvement is the most important work upon which we are engaged. It means, of course, the adaptation of grasses to different soils and climatic conditions. It means a more extensive testing over that long coastline that we have, and it means an intensive search for economic grasses over this area. The hon. member for Cooroora will be gratified to know that our pasture experimental work is guided by a very excellent pasture experimental committee embracing not only officers of the department but also experienced men recruited from outside the department to assist us by their guidance and counsel, and that it enlists also the active co-operation of progressive farmers throughout the State. These instruments are being used for an intensive and vigorous pasture improvement policy. We have pasture improvement work in progress at Daintree, the most northern point in this State where dairying is engaged in. I am assured that Daintree, which is within the tropics, is the closest centre to the equator in the world where dairying is done. That alone is justification for embarking on experiments in that particular locality. If we examine the needs of every locality we find that each has some problems peculiar to itself. These problems have to be examined.

Departmental Literature.

COMMENTING on further favourable criticism of his department, Mr. Bulcock said:—

A good deal of reference has been made during the course of this debate to the "Queensland Agricultural Journal" and its place in the agricultural literature—I use that word advisedly—of our State. Queensland has new problems to face. Differences in climatic conditions, rainfall, and soil types are to be found in different localities. Therefore, we have had to evolve our own literature in connection with all branches of primary production. How well that evolution has been directed and what loyal support has been given by officers of the Department of Agriculture have been evidenced by the favourable tributes that have been paid to the editor of the journal and the staff who have contributed its articles; but I think that it will be agreed that there is one thing that is missing in the agricultural literature of our State. It is true that Ministers of all political parties have recognised the value of pamphleteering; but, after all, that has only a limited value; pamphlets go out of print. We have no classical productions on agricultural possibilities and agricultural processes in our State. I am sure hon. members generally will be pleased to hear that the officers of my department at the present time are compiling an agricultural handbook similar to the agricultural handbook published, I think, in every other State in the Commonwealth, and a handbook that will have special reference to Queensland conditions and will be an invaluable guide to farmers who require an immediate answer to the more perplexing questions with which they are confronted.

The Importance of Tobacco Mosaic.

By L. F. MANDELSON, B.Sc.Agr., Assistant Plant Pathologist.

MOSAIC is a common disease of tobacco wherever it is grown, and no doubt the the characteristic mottled effect of leaves of diseased plants is familiar to most tobacco growers in Queensland. It has been the experience in the past in other countries, and the same tendency is already noticeable in Queensland, that the true importance of this disease is not realised. This is particularly the case when new areas are opened up for tobacco production, as in Rhodesia[2] and in Queensland. Under such conditions inexperienced growers tend to regard this disease merely as an interesting abnormality and fail to realise that, under certain circumstances, it may considerably reduce the market value as well as yield.

Tobacco mosaic has been intensively studied since 1885, when Mayer first discovered that it was a transmissible disease. A considerable amount of this work has been of a fundamental nature since mosaic, which is a virus disease, was the first of this important group of animal and plant diseases to be studied. Many practical aspects of mosaic have also been investigated since its discovery because of its importance as a tobacco disease. Consequently, there is no great need at the present time for original research in Queensland into this well-known trouble. However, it is essential, at this stage of the development of the tobacco industry, that the potential dangers of mosaic should be stressed, and that growers should be made familiar with some of its more important aspects, and with control measures which have given satisfactory results in other countries.

The object of this article is to discuss these various points. Its preparation has been prompted by the fact that some rather striking photographs have just been obtained which appropriately illustrate the harmful effects of mosaic infection. The photographs are of plants used in a recent successful glasshouse infection experiment, and were obtained by the kind co-operation of Messrs. W. J. Sanderson and A. A. Salmon, of the Photographic Branch of the Department of Agriculture and Stock.

Symptoms of Mosaic.

The most obvious symptom of the disease is the characteristic mottling with dark and light green areas irregularly distributed over the leaf surfaces, as is well illustrated in Plate 224. Since it is only leaves which are developed subsequent to infection which show these markings, it is on leaves produced on the upper portion of the plant, or on sucker growth, that these symptoms are most frequently observed. The irregular distribution of the green colouring matter of the leaf blades is associated with uneven growth and consequent buckling and distortion of the leaves. The shape of affected leaves may be quite irregular, varying from long narrow leaves only slightly wider than the mid-rib to leaves of abnormal width and irregular outline. These abnormalities may be observed in Plate 225. Affected leaves are usually thicker and more brittle than normal leaves. Spotting, which persists in the cured leaf, is frequently associated with mosaic mottling.

Symptoms which are sometimes less obvious are dwarfing of the plants, reduction in size of individual leaves with consequent loss of weight, and delayed maturity. These symptoms of mosaic are illustrated

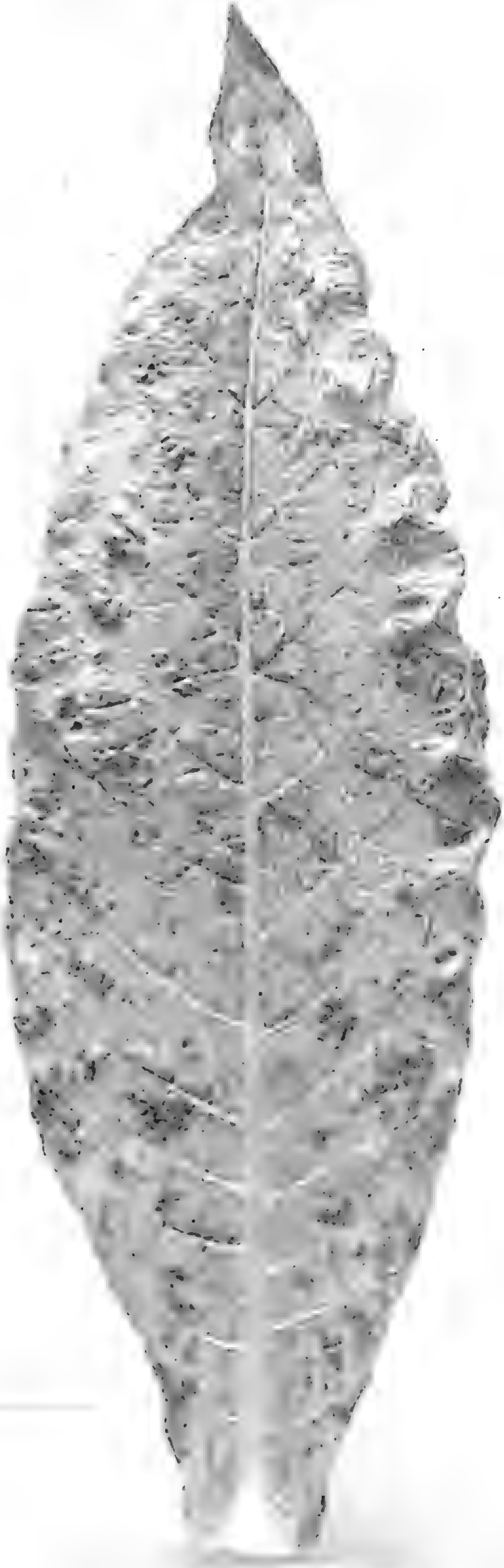

PLATE 224.
Tobacco leaf showing characteristic mottling of mosaic infection.

in Plates 225 and 226. These show healthy plants and plants which were artificially infected when very young with mosaic obtained from diseased leaves collected more than a year previously. Both healthy and diseased plants in each photograph are the same age. It will be noted that five weeks from the time of inoculation the young diseased plants shown in Plate 225, were considerably stunted and distorted. Three months after inoculation an even greater contrast was evident, as shown in Plate 226. This picture clearly shows how mosaic delays maturity. It will be noted also that the diseased plant, besides being much shorter, has developed leaves which are distorted and much smaller than corresponding leaves of the healthy plant.

The severity of mosaic symptoms, and the losses caused by the disease, depend on the age of the plants when infection occurs. The younger the plants when infected the more harmful will be the ultimate results. This infection experiment gives some idea of how harmful these results may be when plants are infected at an early stage.

Furthermore, careful observations in America have recently indicated that mosaic infection not only reduces the yield but also reduces the quality of the cured leaf. Such leaf is uneven, and hence difficult to grade, and its colour is adversely affected as it tends to be dark or to have a greenish cast.

Effect on Yield and Quality.

This important aspect of mosaic disease has been investigated in regard to various types of tobacco in the United States during the past six or seven years.

In 1927 Valleau and Johnson,[5] working with White Burley tobacco in Kentucky, investigated the effect of inoculating plants when being set out in the field and also at topping time. After curing, the leaves were graded and their value estimated by a commercial warehouse. The results showed that when infection occurred at setting-out time, the leaf, as compared with that from healthy plots, was 3 or 4 inches shorter, the yield was reduced by approximately a third (33 per cent.), and the value by two-fifths (43·1 per cent.), on a given weight of leaf. Reference to Plate 226 suggests that the yield might well be reduced by a third under these conditions. The reduction in value per acre was estimated at 61·7 per cent. When plants were not inoculated until topping there was found to be no reduction in yield, but the value of the crop was reduced by approximately a quarter (25·1 per cent.).

McMurtrey[4] reported in 1928 experiments covering a three-year period with Maryland tobacco, which also indicated that both the yield and quality of the crop could be very adversely affected by mosaic, especially when infection occurred shortly after transplanting. In his experiments plants were inoculated either on setting out, one month later, or at topping. Results indicated that inoculation at transplanting time reduced the yield by a third (33 to 35 per cent.), and the gross value of the crop per acre by more than a half (55 per cent.). The damage was almost as severe when plants were inoculated a month after transplanting. When plants were inoculated at topping time the yield was not significantly reduced, but the quality of the crop was appreciably lowered.

As recently as 1933 Wolf and Moss[7] reported a similar investigation extending over two seasons with flue-cured tobacco in North Carolina.

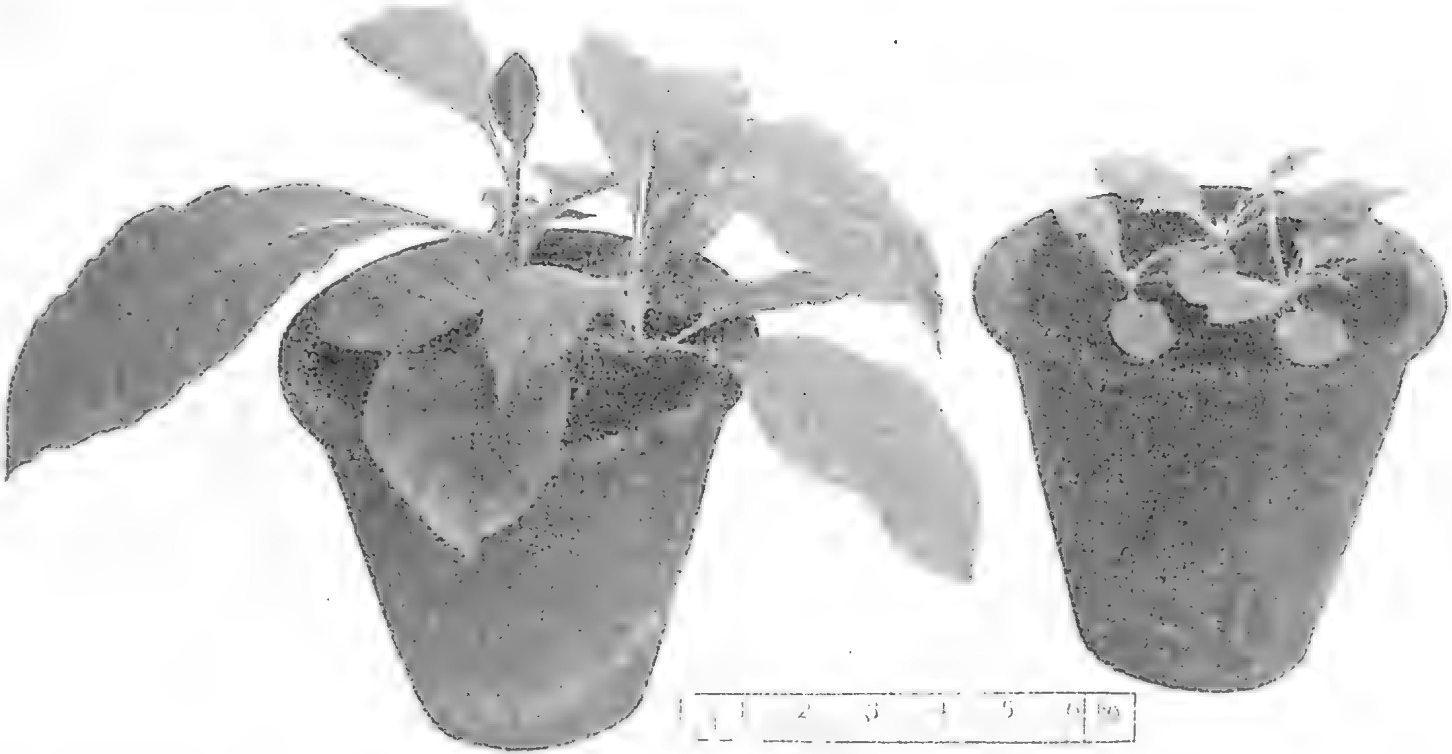

Plate 225.

Tobacco seedlings on 23rd August. Healthy plant on left, mosaic-infected plant or right. The latter was artificially inoculated with mosaic virus on 17th July. Note stunting, distortion, and blistering of leaves.

Their experiments confirmed those carried out with other types of tobacco, which showed that mosaic adversely affects both yield and quality. It was found that—

(*a*) When plants were inoculated at transplanting the yield decreased by approximately a third (31·4 per cent.), and the value per acre by a half (54·6 per cent.);

(*b*) When inoculated a month after transplanting the reduction in yield and value was almost as great (30·1 per cent. and 42·1 per cent., respectively); and

(*c*) When inoculation was postponed until topping the yield was decreased by about a sixth (17·2 per cent.), and the value by almost a quarter (23·8 per cent.).

They observed that mosaic was rarely as severe under natural conditions in North Carolina as in (*a*) or (*b*) of the above experiment, but sufficient mosaic may be present in crops to cause losses in excess of those produced when crops were artificially inoculated at topping.

So far under Queensland conditions mosaic has not been observed to be very general prior to topping, except in some individual crops. After topping, however, it may be very generally distributed, particularly in certain districts, such as Bowen. As yet no carefully controlled experiments have been carried out to estimate the actual decrease in yield in Queensland, but judging from those discussed above the total losses are probably much greater than most growers would imagine.

The Nature and Dissemination of Mosaic Disease.

Mosaic is a virus disease. That is to say, it belongs to a group of extremely infectious diseases which are not caused by any organism that can be definitely demonstrated. Mosaic may be produced by the sap from a diseased plant being introduced into a healthy plant, even though the sap has been passed through a filter so fine as to prevent the passage of germs or bacteria. Consequently, the disease is readily transmitted by handling during various cultural operations and by sucking insects. In this connection it is interesting to note that mosaic is more prevalent in Maryland[4] than in most of the tobacco areas of America, and this is probably due to the fact that there the previous season's crop is usually on the farm while the new crop is growing. Under such conditions workmen who grade tobacco and then handle the growing crop are apt to introduce the disease by carrying infection from one to the other.

Mosaic may affect many other plants beside tobacco. In fact, recent investigation[1] has shown that the host range of this disease now includes no less than twenty-nine species of families other than the Solanaceæ, the family to which tobacco belongs. Consequently, tobacco may become affected by infection being carried to it from one of several crop plants and weeds. For instance, tomato plants are frequently affected with mosaic, and so quite possibly the unusual prevalence of mosaic on tobacco in the Bowen district may be associated with the extensive cultivation of tomatoes in that area.

Mosaic usually originates from the seed-bed. Should one or two seedlings be affected and no precautions taken many other plants will eventually become inoculated during the processes of weeding and

planting out. The disease may exist for a considerable time on old infected tobacco refuse in the soil. Hence, if the seed-bed soil is not properly sterilised some plants may contract the disease from that source. The disease may be introduced from affected crops or weeds in the vicinity of the beds by workmen or insects. Furthermore, as has been already suggested, it may be carried to the seed-bed on the hands of workmen who have handled infected tobacco trash or cured leaf. Again, it has been demonstrated that active tobacco mosaic virus may exist in manufactured tobacco.[6] Hence infection could be introduced on the hands of a smoker. In some parts of America where cured tobacco is commonly chewed, and in Rhodesia where natives who tend the beds make their snuff from tobacco suckers, it is considered that the disease is frequently introduced by these agencies. Even if all the seedlings are perfectly healthy when transplanted, however, some infection may occur subsequently in the field from the remains of a previously affected crop in the soil, should that have been affected with mosaic.[3]

In Queensland where early priming is practised for the control of frog-eye, there is a danger of further distribution of the disease. As demonstrated by the experiments discussed above, it is when plants are inoculated during the seedling stage, and during the first month after transplanting, that they are most seriously affected, and consequently the greatest care should be practised up to this stage. Finally, during topping and suckering operations, still further dissemination of the disease may take place, and consequently it is not unusual to observe a large proportion of suckers showing mosaic symptoms.

Control.

In view of the foregoing remarks, certain precautions suggest themselves for the control of this disease. These precautions may be briefly summarised as follows:—

1. Destroy infected material in the seed-bed soil by efficient soil sterilisation, and avoid the introduction of any tobacco trash after the soil has been sterilised.

2. Eradicate any weedy patches which may occur in the vicinity of the beds, since many plants, weeds and otherwise, may carry the mosaic virus. Particular attention should be given to solanaceous plants.

3. At the commencement of the season all seed-bed equipment should be new or suitably sterilised.

4. After handling any tobacco, cured or otherwise, the hands should be thoroughly washed with soap and water, which will remove the mosaic virus, before working on the seed-beds.

5. The beds should be very carefully examined periodically for the presence of mosaic. Should it be observed, affected plants, as well as those in the vicinity, which may also be affected, should be removed. After handling such plants the hands should be washed. If a large proportion of seedlings are affected, which is unlikely, it would be advisable to abandon the bed and destroy the plants.

6. Examine the seedlings when lifting from the bed, and discard any showing suspicious symptoms. Thoroughly wash the hands in soap and water before proceeding with the work.

7. When the plants have become established in the field make a careful examination for mosaic before commencing priming operations and remove all diseased plants. If this precaution is neglected, and plants are inoculated during early priming, they are apt to become very seriously affected.

Plate 226.

The same plants as shown in Plate 225 on 12th October. Note flower heads of healthy plant, and small distorted leaves and general stunting of mosaic-infected plant.

8. Make periodic examinations for mosaic since plants may contract the disease from contaminated soil in the field, or from infection by workmen or by insects.

9. Should the disease be serious in the field, and should it persist, notwithstanding the above precautions, then it would be advisable to practise a rotation of crops in which tobacco and other susceptible plants are not grown for a year or more.

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PLAIN TURKEY PROTECTED.

The Minister for Agriculture and Stock (Mr. Frank W. Bulcock) has called attention to a Press statement which apparently emanated from Mr. G. H. Barker, State Secretary of the Royal Australian Ornithologists' Union, to the effect that the plain turkey is to be protected closely for two years.

The Minister points out that the statement might convey an erroneous impression that it is intended to apply continuous protection to the plain turkey for the period mentioned, which, however, is not the case. It is intended to rigidly enforce the present protective periods, and to prosecute any offenders. As Mr. Barker has apparently misunderstood the information conveyed to him by the Minister, the text of the communication is supplied herewith:—

"In connection with the desire of members of your Union for total protection to be afforded the plain turkey, I have to inform you that it has now been decided to issue general instructions to officers of this Department and the Police that the protective provisions of "*The Animals and Birds Acts*, 1921 *to* 1924," relating to that bird, should be rigidly enforced during the close season, and that any breaches of the Acts should be reported for action by the Department against offenders.

"At present the periods of protection in this State are as follows:—

Southern Queensland (No. 1 District).—From the 1st October in each year to the 30th April in the following year, inclusive.

Central Queensland (No. 2 District).—From the 1st December in each year to the 30th June in the following year, inclusive.

Northern Queensland (No. 3 District).—From the 1st November in each year to the 31st May in the following year, inclusive

"In addition to the provision of partial protection as above, the plain turkey is totally protected in the Shires of Eacham, Tinaroo, and Woothakata, on the Cairns hinterland.

"Prior to the date on which the protective period will expire in the ensuing year, information will be sought as to whether the measures at present in force for the protection of the plain turkey are adequate."

Queensland Pine Beetle.

By A. R. BRIMBLECOMBE, Assistant to Entomologist.

BORER damage, occasioned to seasoned hoop pine manufactured into furniture or erected as walls, floors, or other structures, has been well known in Queensland for a considerable number of years. Until the end of 1931 the damage in all available records was attributed to a species of Anobium, namely—*Anobium punctatum* De Geer. At that date newly bred specimens of the common Queensland borer, as well as the series already in the collections, were found to belong to a totally different species which Mr. Henry Hacker, who is now in charge of the Departmental collections, identified as *Calymmaderus incisus* Lea. A thorough examination and dissection of a large series of borer-damaged hoop pine specimens was then made by the writer, and revealed in every case dead adults of the latter insect. Thus, since the type of damage was prevalent and *Anobium punctatum* was absent from the collections, it appeared certain that Anobium could be considered of little or no consequence in Queensland, and the transference of responsibility for damage to *Calymmaderus incisus* seemed reasonable.

However, in November, 1933, a hoop pine floor exhibited damage somewhat dissimilar to that of *Calymmaderus,* and on dissection of the boards dead adults and living larvæ were secured. These adults proved to be *Anobium punctatum.* This, then, is the first authentic Departmental record of that insect as a timber pest in Queensland. Recently a further record was obtained when a damaged board, extracted from a piano, revealed on dissection dead adults of this insect, the timber being of foreign orgin. In spite of these records, *Calymmaderus incisus* is still considered to be of greater economic importance in this State.

The European furniture beetle, *Anobium punctatum,* is of almost world-wide distribution. Consequently, it has been discussed in numerous publications both in Australia and abroad, and the present article is accordingly intended to deal primarily with *Calymmaderus incisus,* but because of their systematic affinity and the similarity in damage and control the two insects will be compared and contrasted.

Early Records.

The first reference in Queensland literature to Anobium damage occurs in the annual report of the Department of Agriculture and Stock for the year 1897-8, wherein Mr. Tryon notes "Introduced pine wood, Anobium beetle (?Theca sp.), Brisbane." Other early records occur in similar reports for the years 1898-9, 1902-3, 1905-6, 1907-8, 1910-11, and 1918-9. The first reference to a specific host appears in 1910-11, wherein Mr. Tryon reports, "Pinhole borer (Anobium sp.), white pine, *Araucaria cunninghamii,* Redland Bay and Brisbane, where it is becoming very prevalent and proving highly destructive."

Although *Calymmaderus incisus* was not described until 1924, it is quite likely, from the evidence just given, that some of the above early records refer to this insect. At any rate, specimens in the collections obtained from *Araucaria cunninghamii* in 1921 and placed under Anobium sp., have now been identified as *Calymmaderus incisus*; so this insect can be regarded as a pest of long standing.

Mr. Robert Veitch, Chief Entomologist, made, last year, the first reference in literature to the economic status of this species.[1]

Timber Attacked.

With one exception all the timber specimens from which the Queensland furniture beetle has been obtained, together with the flooring board which produced *Anobium punctatum*, on being submitted to the Forestry Sub-Department, were returned with the identification in every case as *Araucaria cunninghamii*—i.e., Queensland hoop pine. The single exception was a specimen of New Zealand white pine, *Podocarpus dacrydioides,* which was found to be heavily infested by Calymmaderus.

Roughly and Welch[2] give a list of Australian timbers, also one of exotic timbers, which are liable to Anobium attack. Of the Australian species, hoop pine is the only one so far confirmed in Queensland. W. W. Froggatt[3] reports that *Anobium punctatum* does not attack Australian timbers. Overseas, a variety of woods, such as alder, beech, birch, fir, dead ivy branches, oak, pine, spruce, and willow, are listed as hosts. Zacher[4] records it as eating holes in linen tablecloths.

Age and Nature of Timber Attacked.

Well-seasoned timber, as exemplified in buildings many years old, is the most liable to Calymmaderus attack. The older the wood the more favourable it seems to be. Specimens harbouring living larvæ possess an equilibrium moisture content of about 12 per cent., although this degree of dryness is not claimed as the only factor conducive to attack. Timber, in ageing, changes slightly in chemical composition, which fact might exercise a selective influence on gravid females.

The timber from which Anobium was recently taken was reputed to be forty years old and had an equilibrium moisture content of 12 per cent., while Calymmaderus is breeding in a house supposed to be more than thirty year old. With both insects, once infestation has occurred, reinfestation may proceed, producing several generations from the same site, until the wood is reduced to a honeycombed mass, when attraction declines.

Nature and Extent of Damage.

A piece of infested timber sliced longitudinally exhibits an admixture of various sized holes, which illustrate the nature of the grub's progress. The minute holes are practically all cut transversely, indicating that a newly-hatched grub from an original infestation tunnels perpendicularly to the surface. The larger tunnels are exposed in all directions. The more mature grub, by avoiding cutting into earlier-formed portions of its own tunnel or severing the tunnels of other individuals, travels wherever sufficient solid wood permits, and accordingly its course is exceedingly devious. At all times it avoids breaking the exterior surface. This, however, is punctured by the beetles when emerging from the pupæ a year or more after egglaying. It is evident, then, that in instances of original infestation the first external indications of depredation are the exit holes of the adults, but, unfortunately, in the meantime damage will have been effected, for the preceding grub stage does all the internal tunnelling. In Plate 227, figs. 2 and 4, the portions illustrated reveal only a few exit holes, whereas the underlying damage is extensive; so the number of holes is of little significance in estimating the severity of attack. The beetles, after emergence, do no more actual harm to the timber.

PLATE 227.

Fig. 1 (top left).—Hoop pine damaged by *Calymmaderus incisus.* Lateral view of portion in Fig. 2 showing thinness of outer shell.

Fig. 2 (top right).—Hoop pine heavily damaged by *Calymmaderus incisus.*

Fig. 3 (bottom left).—Hoop pine damaged by *Anobium punctatum.*

Fig. 4 (bottom right).—Hoop pine showing internal damage and exit holes of *Calymmaderus incisus.*

Attack is not necessarily confined to any particular part of the timber. Whether it is sapwood or truewood, the final degree of damage is the same, although in a few instances the proportion of exit holes from the first generation was greater in that part of the board nearer the sapwood. Board to board grub dispersal may occur, but not extensively, and cumulative infestation of timber is almost invariably due to egglaying by the beetles. While the degree of initial infestation varies, it is generally light, although in one instance a ceiling exposed to a large population of beetles became infested in practically every board and for the whole length of the boards. Usually, general infestation obtains only with the progress of succeeding generations. If the insect remains unchecked the whole hoop pine interior of a building may become affected. Ultimately the infested wood is reduced to a honeycombed spongy or crepe rubber-like mass covered by a thin shell punctured by exit holes (Plate 227, fig. 2). So great has been the damage in many instances that hoop pine furniture and shelves have collapsed, and floors have broken under the weight of heavy furniture, while a lead pencil may be pressed through heavily infested floors and walls. A heavily damaged board 6 inches wide and ¾ inch thick snapped in the hands almost as easily as a match splinter.

The above information is also fairly true of Anobium, except that the damaged timber has not the same spongy nature. Anobium tunnels may be devious, but there is a greater tendency for them to be parallel to the surface and to one another (Plate 227, fig. 3).

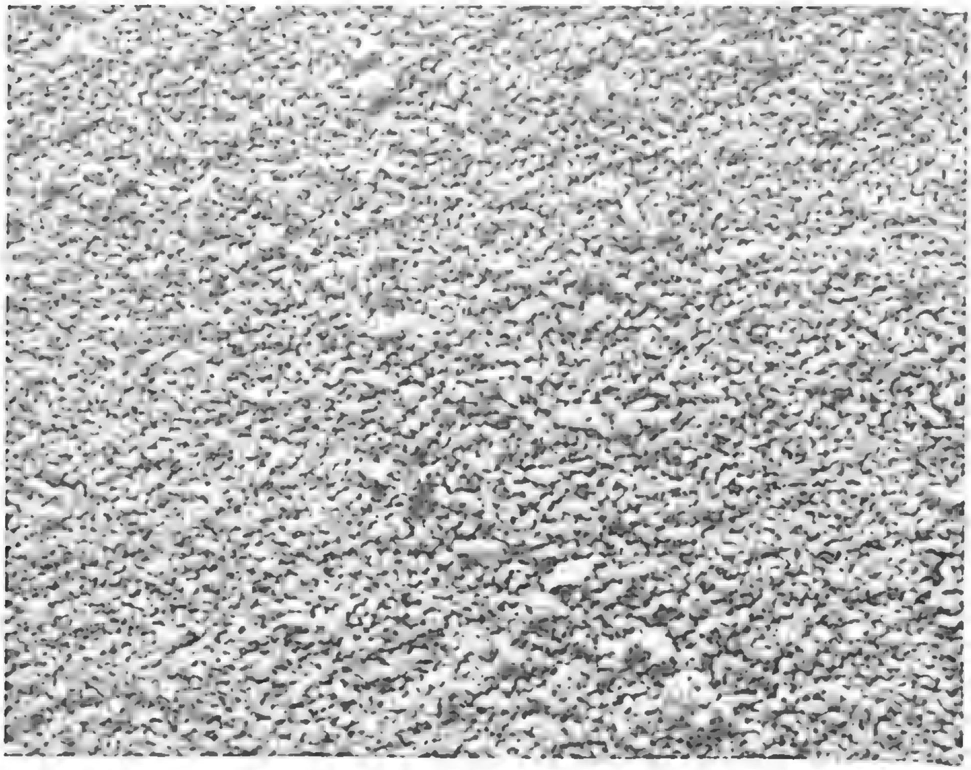
The Calymmaderus damage is characterised and may be identified by the frass (Plate 228, fig. 2) with which the grubs fill the tunnels. This consists of undigested material and rejected particles which, intermixed, fill the tunnels closely but not tightly, for when exposed it can be easily shaken out. The undigested material is in the shape of small elongate oval pellets, slightly pointed at one end and typically of a very hard consistency. In old hoop pine they are mostly darker in colour than the rejected particles and surrounding wood; the colour difference in New Zealand white pine is not so striking. The proportion of pellets to rejected particles is large.

The frass of Anobium grubs (Plate 228, fig. 1) is somewhat different. The pellets are smaller and of a more crumbly consistency; in old hoop pine they are not different in colour from surrounding wood, and the proportion in comparison with rejected particles is not so large.

Origin and Distribution.

Apparently *Calymmaderus incisus* is indigenous to Queensland; no record of its occurence elsewhere has yet appeared. It was originally described from specimens taken in Brisbane, and it is to this State that its natural host, hoop pine, is indigenous.

Most sections of the Brisbane area have yielded records of Calymmaderus damage, and the beetle population therein is evidently very high. The occurrence of damage in such widely separated towns as Southport, Sandgate, Petrie, Redcliffe, Nambour, Tewantin, Imbil, Gympie, and Maryborough indicates a long range, comparatively near the coast of south-eastern Queensland. Whether it extends within the tropic or to the interior has not yet been ascertained. *Anobium punctatum*, as previously mentioned, is of almost world-wide distribution, and is considered to be native to Europe.



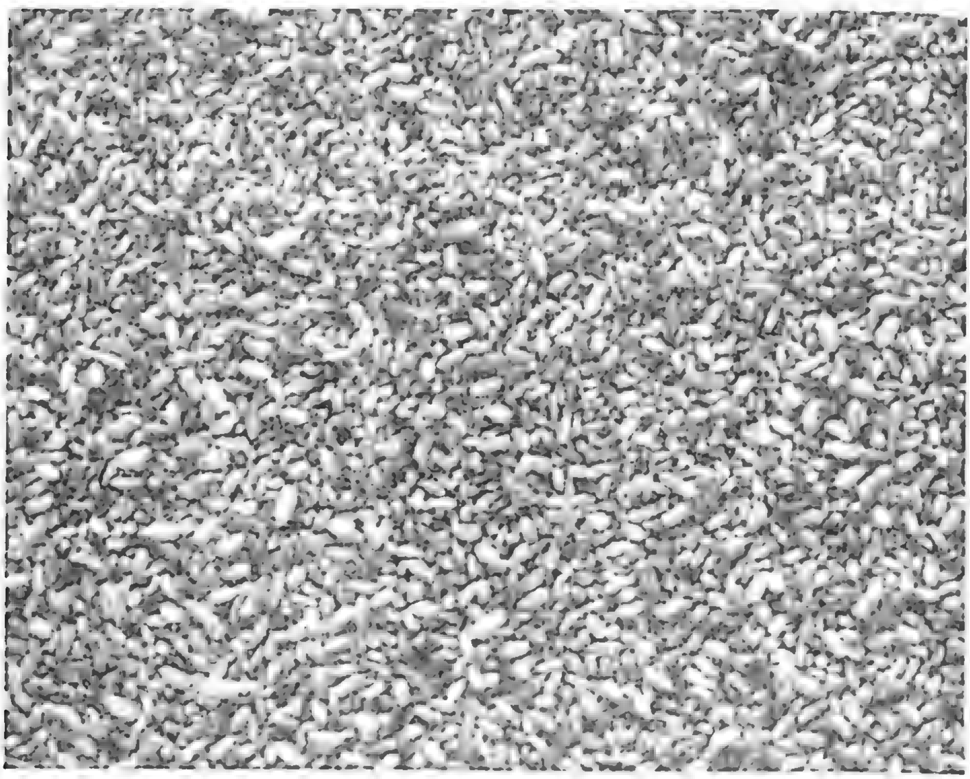


PLATE 228.

Fig. 1 (top).—Frass of *Anobium punctatum* × 7½.
Fig. 2 (bottom).—Frass of *Calymmaderus incisus* × 7½.

Habits and Life History.

The eggs of Calymmaderus in initial attacks are deposited in depressions on the sawn board ends or in cracks in the boards, while the spaces between tongued and grooved boards are particularly attractive for egg-laying. A favourite site for eggs of subsequent generations is within the old exit holes. When placed in cavities on board ends they are below or flush with the surface level. Small openings such as these are chosen possibly because of the initial leverage required by the minute grub in gaining entrance to the timber as well as for protection during incubation. All sixteen eggs laid in the laboratory were deposited in cavities on block ends—three in one opening, four in pairs, and the remaining nine singly. The actual period required to incubate these eggs was not definitely determined, but occupied three to four weeks.

The beetles of Anobium choose similar sites for oviposition. Overseas records show that a single individual may lay from twelve to forty eggs, and the incubation period may occupy about three weeks.

The newly-hatched Calymmaderus larva is minute, and the tunnel it bores is correspondingly small—in fact, is no larger in diameter than the prick of a pin point. It immediately enters the timber in a direction perpendicular to the surface chosen for oviposition wherever that may be, thus working away from the light. Although the optical organs are rudimentary, the perception of light is remarkable, and at all times the breaking of any exposed board surface is avoided. Even very small tunnels deflect the course of the young grub, but to the older ones these present little hindrance. As growth proceeds the grub moults three times, the third moult producing the pupa.

The tunnel to accommodate the grub becomes increasingly larger until the trail left by a mature grub is circular and 1·5 to 2·0 mm. in diameter (Plate 227, figs. 2 and 4). Due to the curved nature of the grub the posterior end, which is studded with a few spines, presses against the tunnel wall, and this causes the dorsal surface, which is provided with bands of spines, to come into close contact with the wall above. Thus there is ensured a keen purchase to enhance the efficiency of the stout, hard jaws which, by chewing off pieces of wood, most of which are swallowed, effect the grubs progress through the timber. When placed on a flat surface the young grub can crawl very slowly, but the older individual in similar circumstances is helpless. Mastication of the hardwood fibres occurs in the muscular gizzard on the inner walls of which are innumerable spines for thoroughly effecting maceration.

Subject to a heavy infestation the wood decreases appreciably in weight, but the actual pieces chewed off do not cause this, for they do not leave the timber. The nourishment taken from them is converted into energy, which is dissipated as the grubs work. This conversion to energy, which is totally lost as far as measurable weight is concerned, is the explanation for diminished wood weight.

When the grub is full grown, its tunnel is usually directed to a suitable position just beneath the timber surface, where a pupal chamber is excavated. Often, however, especially in fairly heavily damaged wood, the pupal cells occur at quite considerable depths. The pupal chamber is oval in shape, 4·0 to 5·0 mm. long, and half as wide. The grub now completely confines itself by sealing the tunnel with fibre fragments and frass glued together in the form of a neat circular concave

cap. After a while it casts its skin, which passes to one end of the chamber, and the insect is now in the pupal stage.

The larval period has not yet been completely determined. This period might be ten or eleven months; however, it is not improbable that it might extend well over a year, since as late as April, 1934, when cool weather was approaching, first and last stage larvæ were both abundant. These first-stag grubs definitely were from eggs laid during the season immediately past; the third-stage grubs must have developed from the previous season's eggs and will not emerge as adults until next spring.

The habits of the Anobium larva are somewhat the same as those of Calymmaderus, except that the tunnels it bores are more inclined to run parallel to each other. Its food has been found to consist chiefly of cellulose, of which the wood cell walls are partly composed. Falck[5] noted a decrease of about 9 per cent. of cellulose in attacked pine sapwood. The larval period under normal conditions lasts for ten or eleven months, but in very warm climates it may be less than six months, whereas in cooler countries it may extend over two years. Pearson[6] had under observation larvæ which had not completed the stage in two and a-half years.

When the insect is about half way through the pupal stage the eyes slowly turn black; later the brown jaws are discernible through the pupal skin; then shortly the whole becomes light-brown, due to the development of the adult within. Eventually the adult splits the skin about the region of the thorax, and as the beetle emerges this skin is pushed along the body and off at the posterior end. However, the adult is still immature, and so rests within the cells, where it slowly darkens in colour and gains in strength. Ultimately, it burrows to the exterior, making the obvious exit hole so indicative of borer presence. For both Calymmaderus and Anobium the pupal period occupies from three to four weeks.

The short resting spell of the adult within the pupal cell is probably of sufficient duration to permit the complete development of the reproductive organs allowing the beetle to commence mating immediately on emergence. Egg-laying, then, can probably be anticipated shortly after the appearance of exit holes. The gravid female wanders over the timber surface, with its antennæ extended, searching for suitable egg-laying sites. On locating a favourable cavity it inserts its ovipositor, which neatly places the egg. As mentioned in an earlier paragraph, of sixteen eggs, three were in the one cavity, four were in pairs; the others occurring singly, the number occurring in each cavity probably being dependent on the size of the cavity. The total egg production possible from a single female is not known. Oviposition may extend over several widely separated sites; and as adults can fly freely, house to house dispersion takes place readily. Great activity becomes evident amongst adults at dusk, and possibly continues into the night, while in a fairly dark room they remain exposed and active even at midday.

A disturbed beetle does not take to flight or scamper away, but a passive disposition is assumed in which it is difficult to say whether the insect is dead or alive. The head is retracted under the cowl-like prothorax, the legs are tightly adpressed to the body in suitable depressions, and the mouth points backwards, enabling the antennæ to fit conveniently into a cavernous sternal groove, completely accommodating

and protecting them. The form now assumed is a small oval solid, which should be effective in resisting external forces. If dropped, a beetle in this passive state immediately takes to flight.

This habit is also common to the Anobium beetle. The head and appendages are retracted, but because of the insects' more elongate form, and the absence of suitable depressions for the legs, the even oval shape of Calymmaderus is not possible. In other general habits the adult Anobium may be likened to that of Calymmaderus.

Seasonal History.

Adults emerge from October to February, over the whole of which period egg-laying occurs. The grubs may continue to tunnel during the winter or may remain dormant for a while, their activity or otherwise depending on the severity of the weather. With the advent of spring, grubs from eggs laid early in the preceding season might give rise to pupæ. Experimental work also indicates that grubs from late eggs might have an extended period continuing into the following summer and not emerge as adults until the second spring. Possibly such factors as climate and condition of wood exercise significant influence on the life-cycle period. Pupation commences in the spring, and by extending into the summer makes available adults at various times during the warmer weather, so oviposition can be expected at any time in the summer.

Anobium is recorded as having normally a yearly cycle, but under warm conditions two generations a year are known[7], whereas in cooler climates the life cycle extends to two years and over[6].

Vernacular Name.

In literature *Anobium punctatum* is referred to as the "furniture beetle," and in Europe is designated the "common furniture beetle." Although its depredations are not confined to furniture, the name is retained because of long usage. Because of the general similarity to Anobium, *Calymmaderus incisus* had provisionally received the name "Queensland furniture beetle." Here again the greater percentage of damage is to wooden structures other than furniture. For this reason, together with the facts that the insect is indigenous to Queensland and has been bred only from pine, it has now been designated the "Queensland pine beetle."

Systematic Position.

The Queensland pine beetle was described as *Calymmaderus incisus* by the late A. M. Lea in "Transactions of the Royal Society of South Australia," vol. 48, p. 53, 1924, from specimens obtained in Brisbane. It belongs to the family Ptinidæ, subfamily Anobiinæ; hence its relationship to *Anobium punctatum* described by De Geer in 1774.

Most members of this subfamily are of economic importance, other well-known species being *Sitodrepa panicea* Fabr., which is highly destructive to numerous dry preserved products, and *Lasioderma serricorne* Fabr., which causes considerable loss to stored tobacco.

The borers Calymmaderus and Anobium must not be confused with the common and notorious "powder post beetle," *Lyctus brunneus* Steph., which belongs to a totally different family of insects and has never been bred from hoop pine.

Description of Stages.

The very small white egg (Plate 229, fig. 1) is ·4 mm. in diameter and is just discernible to the naked eye. The shape is more or less spherical, but that portion of the egg in contact with the timber may assume the shape of the cavity into which it has been placed. The egg shell or chorion exhibits a remarkably pretty reticulate appearance, numerous minute protuberances being present. The egg of Anobium is also minute, white in colour, but oval in shape.

The Calymmaderus grub (Plate 229, fig. 2) is soft bodied, curved, and wrinkled, and is creamy-white in colour except round the mouth, where the mandibles are dark-brown. When full grown it measures 4·0 to 5·0 mm. in length and 1·5 mm. in width, being widest at the thorax, each segment of which is provided with a pair of short white five segmented legs. The anal body segment is broadly rounded and slightly wider than the others, due to a tendency to lateral lobing. The outer portion of the maxilla—i.e., the maxillary palp is four segmented, short, and peg-like, while the inner part is provided with numerous blunt processes, giving it a comb-like appearance. The labial palps are similar to those of the maxillæ. The whole body is clothed with numerous fine hairs. Each segment, from the third thoracic to the fifth abdominal, is provided dorsally on the more elevated portion with a band of brown spines slightly curved backwards at the tips. Posteriorly on each side of the last abdominal segment is a group of similar spines varying from eight to fifteen in number. None of these spines occur in the first-stage grub, while in the second stage they are few in comparison with the last stage, and often are in only one row. A spiracle is situated on each side of the first thoracic and first to eighth abdominal segments, the spiracles being practically uniform in size.

The Anobium larva (Plate 229, fig. 6) is very similar to Calymmaderus in general features. The only obvious difference and a good one distinguishing the larvæ of the two species is that the Anobium grub has eight bands of dorsal brown spines, while Calymmaderus has only six; again the Anobium larva has no spines on the anal segment. Gahan[8] mentions the dorsal spines as being in a double row in Anobium, but a series of grubs recently examined indicates that although there may appear a tendency towards two rows, the arrangement is by no means regular. Sometimes one or three rows are distinct. The same applies to Calymmaderus.

The pupa (Plate 229, fig. 3) is soft, oval, creamy-white, and measures 3·0 to 3·5 mm. in length and 1·5 mm. across the thoracic region. The wing covers fold round to the under side, where they pass between the second and third pairs of neatly folded legs, while the antennæ lie along the side of the body outside the wing covers and above the knees of the first and second pairs of legs. There is no obvious difference in the Anobium pupa except that it is slightly longer.

The Calymmaderus beetle (Plate 229, fig. 4) is oval in shape, 2·5 to 3·0 mm. long, and 1·25 to 1·5 mm. wide, the general colour being a shining bright castaneous. Over the body surface is a minute shining pubescence and numerous minute punctures, neither discernible to the naked eye. When a beetle is specially cleared, a series of punctures arranged in longitudinal rows on the elytra are revealed, while scattered generally over the surface are smaller punctures, from which the pubescence arises. On the margin of each elytron are two distinct striæ.

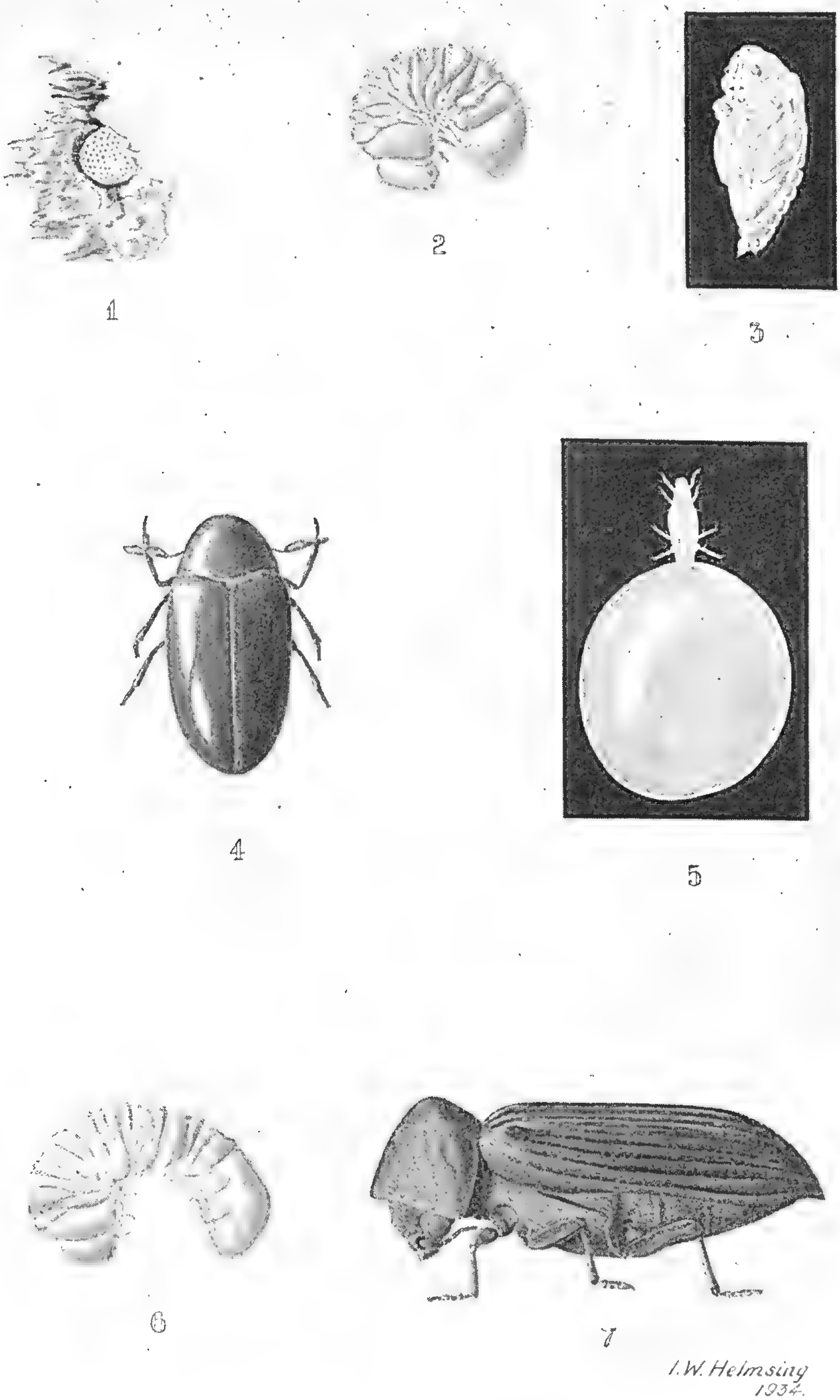


PLATE 229.

Fig. 1.—Egg *in situ* of *Calymmaderus incisus* × 24.
Fig. 2.—Larva of *Calymmaderus incisus* × 8.
Fig. 3.—Pupa of *Calymmaderus incisus* × 8.
Fig. 4.—Adult of *Calymmaderus incisus* × 15.
Fig. 5.—Adult female of *Pediculoides ventricosus* × 60.
Fig. 6.—Larva of *Anobium punctatum* × 8.
Fig. 7.—Adult of *Anobium punctatum*, × 15.

Antennæ consist of eleven segments, of which the basal one is large, second smaller, third smaller still, but fourth to eighth smallest and about equal in size. The ninth is largest, oblong, and as long as the tenth and eleventh combined, each of which is about equal in length to the first segment. The last three segments give the appearance of a large elongate club clearly visible when the antennæ are extended. Maxillary palps are four segmented, labial palps three segmented; the terminal segment of each is dilated interiorly into a hatchet-like blade. The legs are moderate, and the tarsi consist of five segments—the first largest, the others about equal in size. The fore and mid legs are contiguous, but the mid and hind legs are widely separated by the prominent metasternum. The mesosternum is inconspicuous. The prothorax narrows anteriorly and, dorsally, is simply curved not angled as in Anobium. Impressed into the prosternum, over the whole of the mesosternum, and into the anterior of the metasternum is a common depression for the fore and mid legs when folded. The first abdominal sternite and the hind part of the metasternum provide similar depressions for the hind legs; the first abdominal sternite then appears as a curvilinear triangle, with the apex anteriorly. This apex fits into a corresponding socket in the metasternum. The cavernous sternal groove involves the prosternum and mesosternum, and continues into the metasternum, where it ends abruptly, corresponding with the blunt end of the last antennal segment.

The adult Anobium (Plate 229, fig. 7) differs from Calymmaderus in many respects. In shape it is more elongate, being 4·0 to 5·0 mm. in length, and the colour varies from reddish-brown to dark-brown, modified by a clothing of fine short paler coloured hairs. Clearly visible on the elytra are a series of longitudinal grooves, along which are numerous closely-set punctures. The prothorax in lateral view is distinctly angled or cowl-shaped. The sternal groove is present and continues further into the metasternum, but it is not so cavernous and shallows gradually, corresponding with the tapering last antennal segment. The legs in comparison with Calymmaderus are longer, and although they may be neatly folded, they do not fit into accommodating depressions. The fore and mid legs fit into the angles between the prothorax and elytra; the hind pair fit behind the metasternum since this is slightly larger than the first abdominal sternite. The last three antennal segments are about equal in length and also give a clubbed appearance.

Natural Enemies.

Both the larval and adult stages of Calymmaderus and Anobium are preyed upon by a small mite, *Pediculoides ventricosus* (Newp.) (Plate 229, fig. 5), which also has been recorded from Anobium grubs in Russia[7]. This mite is responsible for the death of quite a number of grubs. As many as twenty-three females and several young mites have been found associated with one dead Calymmaderus larva, six to twelve female mites per grub being common. The beetle larvæ having soft bodies may be attacked anywhere, although on the ventral side under the arched body is preferred. The adults, however, are heavily chitinised except on the upper side of the abdomen under the elytra, and it is here that the mites are usually found. Even so, the percentage of control it exercises is small, because the dispersion and isolation of grubs and adults is not conducive to a general attack by the mites. At the same time the presence of this mite in a dwelling is not really desirable, for

it may attack human beings also. Uncomfortable conditions were experienced by the writer when working with material infested by this mite. This is in agreement with reports in a recent article by Swan[9] in South Australia, who calls it the hay itch mite and who has completely worked out its biology.

Anobium is parasitised by a small hymenopterous wasp of the family Braconidæ. Again the degree of control is not large. Overseas there are recorded several Braconid parasites and a few coleopterous predators of the family Cleridæ and one of the family Trogositidæ.

Artificial Control.

Since the recorded natural enemies give little help in the attack against these borers, alleviation of infestation must necessarily be sought in the application of artificial measures. From the outset it must be recognised that in this respect the problem of control is an extremely difficult one, because the destructive insect stage is well entrenched within the timber and securely protected against ordinary control practices. Even though certain recommendations are outlined below, these are not absolute in efficiency, but if persevered with they will considerably minimise if not eliminate the cause of the trouble. A great disadvantage presents itself in that, when original infestation occurs, there is no indication of its presence, the appearance of exit holes being the first evidence of attack. Even though only a few of these are present, the underlying damage may be extensive, for the grubs have been tunnelling for some considerable time previously. Control efforts, then, must be to take immediate steps to kill the insects remaining in the timber and to prevent reinfestation or spread to new sites.

When to Apply Control.

The salient life history features affecting control are that the female is free-living and causes reinfestation or spreads the attack, eggs are more or less exposed, and young and very old grubs, pupæ, and emerging adults are comparatively near the surface. A control applied at a time corresponding to the insects' presence near the surface should prove beneficial, and such a time is the spring. Control applied during that season should accordingly reduce the number of potential adults. At least one subsequent treatment should be made about six weeks later in order to kill insects which earlier were too deep to be affected and which now should be approaching the outer surface.

Preventive Measures.

In the normal course of events most hoop pine interior walls are now painted and the pine floor stained, but following this the undersurface of the floor and the board ends usually projecting under the building against the beams should receive some protective coating, such as creosote. Any exposed cracks appearing later, due to shrinking of the boards, should be treated with paint or creosote as the case demands. In this way all egg-laying sites are eliminated. Even though floors have been stained above or covered by linoleum, instances of attack are exceedingly numerous and invariably originate from below, which, then, is a vital point in preventing infestation. This can quite easily be completely overcome by substituting for flooring purposes seasoned hardwood, which is as cheap or cheaper than hoop pine.

Combative Measures.

Control in most cases is possible only from the exterior, the best method being to apply some liquid possessing penetrative power and evolving a gas which spreads still further. At the same time it might be possible to include a poison in the mixture used, to become absorbed by the timber, thereby killing any insects chewing the impregnated wood. Several penetrative materials are already on the market or can easily be prepared.

Heavily infested boards may be so reduced in stability as to become dangerous, and these should be removed and burned. Replacements and lightly attacked timber should then be treated. The liquids can be applied by a brush or spray pump, and can be injected into any exit holes by means of a suitable syringe. If only a few holes are showing, injections alone are insufficient on bare boards, as the effect then is only localised; so in any case, brushing or spraying is essential. The best mixture applied to the outer surface unfortunately penetrates to a depth of only about one-eighth of an inch. For this reason each application kills only a proportion of the insects within, hence with repeated treatments at suitable intervals the effects are cumulative. At the same time the coating on the surface renders it unsuitable for further egg-laying.

Methods of Treatment.

Heavy-grade creosote is an effective oil for general application, and is readily available on the market at a relatively low cost. It possesses fair penetrative power and evolves a good concentration of gas, and both liquid and gas effect a kill when they come into contact with living borers. This creosote, however, causes a dark, flat, or dull stain, which in itself is not really objectionable, but the success of subsequent coats of paint, varnish, or polish might be impaired.

The creosote can be diluted with kerosene, a suitable mixture being equal parts of each. This leaves a light stain, and the rate of evolution of the fumes is slightly reduced. A dilution of one part of creosote to eight of kerosene has been recommended, and although this still leaves a very light stain when heavy-grade creosote is used, a good varnish finish is possible with two coats. There is, however, a refined creosote on the market which itself produces little or no stain, and though the rate at which fumes are evolved is said to be very much slower than the heavy grade, it may meet requirements in certain cases.

Kerosene alone might in individual instances prove beneficial, but penetration is not very good on fairly solid timber. The same objection applies to turpentine alone, yet a mixture of these two in equal parts has given more favourable results, although its action is much slower than a material containing creosote, and consequently more applications will be necessary.

Another suitable mixture is paradichlorobenzene dissolved in kerosene, at a strength of 1 lb. of paradichlorobenzene crystals to 1 gallon of kerosene. The liquid, orthodichlorobenzene, used alone might be considered costly, but mixed in kerosene to give a 5 to 10 per cent. solution it makes a reasonably priced mixture. Neither of these preparations leaves any stain.

Painting appears to be the most suitable method of applying the above liquids and entails no special apparatus. Spraying may be more

convenient and quicker if the right pump nozzle is available. Certain nozzles produce a mist so fine that there is little adherence to the timber, while with others considerable splashing results. In all cases the degree of control depends on the thoroughness of the work.

Reasonable care must be exercised in the application of the abovementioned chemicals, for contact with the skin may induce irritation, and they must not be exposed to naked lights, for the mixtures are inflammable.

Preparations containing soluble poisons, such as sodium arsenite, zinc chloride, or mercuric chloride, do not effect such a rapid kill as one including creosote, for a proportion of the poisoned timber must be swallowed before death ensues. These chemicals are so very poisonous that they are not recommended unless in the hands of skilled workers.

Fumigation is another possible means of control. This is more restricted in its application, since an airtight room or container is essential; for this reason the method is more appropriate to treatment of infested furniture or other comparatively small articles. Carbon bisulphide may be employed exposed in several shallow vessels, or poured over cotton wool or absorbent cloth at the rate of 1 lb. per 250 cubic feet of space. Paradichlorobenzene may be sprinkled at the rate of 1 lb. in 25 cubic feet. Exposure to the fumes must be maintained for several days, or even up to a week, to enable complete penetration of the borer tunnels. When small articles are to be fumigated it might be more convenient to communicate with firms possessing the necessary chamber, of which there are several in Brisbane, and who might treat material at a reasonable cost. Fumigation, although thorough in killing all living insects in the timber, is no guarantee against reinfestation, and a protective coating is therefore necessary.

Summary.

The beetle, *Calymmaderus incisus* Lea, has recently been discovered to be the causal agent of considerable and serious damage to seasoned hoop pine in Queensland. Although not described until 1924, it was undoubtedly responsible for considerable losses at a much earlier date. Its range, as at present known, covers the whole south-eastern portion of this State. All stages have been obtained, and life history work is proceeding in the laboratory, but as yet the life-cycle study has not been completed. Hoop pine and New Zealand white pine are attacked, the timber eventually being reduced to a sponge-like mass. Complete descriptions of habits and stages are given. At present creosote alone, or mixed with kerosene, and painted on affected timber, first in the spring, with at least one treatment later in the summer, is the best method of control.

Anobium punctatum De Geer occurs in Queensland, so far only to a minor extent and only in hoop pine. In this article it is compared and contrasted with *Calymmaderus incisus* in all details.

Acknowledgments.

Thanks are expressed to Mr. Robert Veitch, Chief Entomologist, for granting facilities for this work, and to Mr. I. W. Helmsing, whose excellent illustrations enhance these notes. The writer is also much indebted to several officers of the Forestry Sub-department who have assisted materially in this investigation.

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CLEANLINESS IN THE DAIRY.

Professor J. K. Murray, Principal of the Queensland Agricultural College and High School, said, in the course of a recent address, that the effects of impure water in the manufacture of butter lay mostly in its adverse effect on butter quality, and this arises in the use of such water on the farm in milk production as well as in the factory. The factory was unable to offset entirely the bad effects of dairy farm methods which did not conform with good hygienic practice. Deodorisation, pasteurisation (and its variants such as stassanisation) could remedy only a portion of the ill-effects of farm and transport procedures which, for whatever reason, did not reach a high standard. The watering of cows which allowed of the flanks and udder becoming contaminated from muddy water made it almost certain that the milk would be contaminated by the water residues from the flanks, udder, escutcheon area, and tail. This could be partly offset by the cleaning of the cow's flanks, tail, udder, and teats before milking, but clean watering was an advantage.

The washing of milk pails, strainers, separator parts, cream cans, &c., in contaminated water almost made it certain that the microbes would bring about their undesirable changes in the milk and cream before it reached the factory. Good-quality water should be used, and the immersion of utensils in boiling water for a minute would remove danger from this source. During the earlier stages of the milk's history the putrefactive group might do their most marked work because of the near approach of the milk at that stage to neutrality.

The harmful gas-forming group of bacteria was a notable contaminant of milk when impure water was used or manurial contamination occurred in farm practice. This group could work in milk in which acid was being produced by themselves or other bacterial groups, and was favoured during storage and transport to the factory by the warm conditions prevailing in the Queensland summer. Distinctly off-flavours resulted and gas was produced. Yeast contamination, ropy milk outbreaks, and other phenomena of lesser importance had also been traced to farm-washing waters.

The cooling of cans by dirty wet bags could result in the contamination of milk or cream by dirty water. Prolonged transport allowed of longer activity by organisms derived from dirty water, and the remedy rested in better roads with their lower haulage costs and the more frequent delivery this made possible. Faster rail transport, such as the rail-motor had made possible in connection with some of the factories, lessened the amount of undesirable substances produced before the vast majority of the microbes still forming them were destroyed by pasteurisation.

The passing of the nearest factory by the supplier was, other things being reasonably equal, definitely against the interests of the industry.

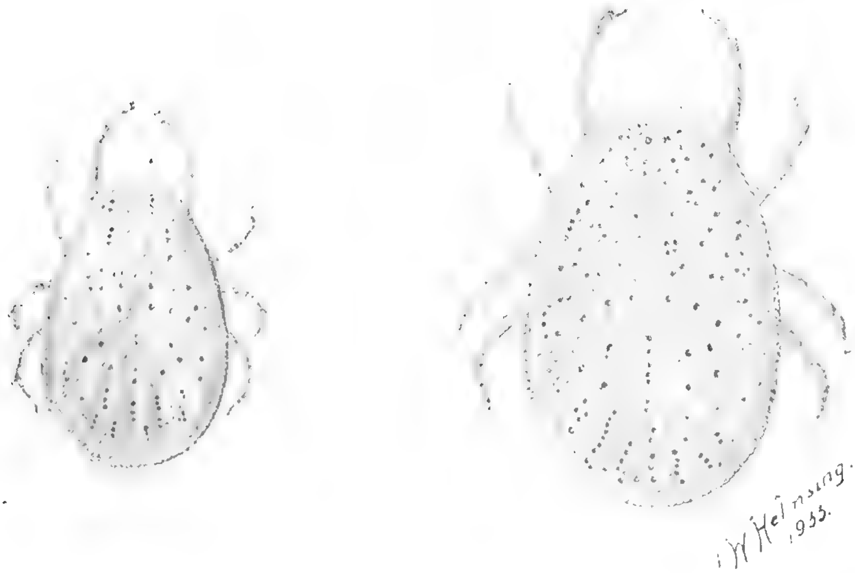
The Parasites of Poultry.

By F. H. S. ROBERTS, M.Sc., Animal Health Station, Yeerongpilly.

EXTERNAL PARASITES.

THE external parasites of the domestic fowl include the poultry tick and several species of lice and mites.

THE POULTRY TICK (Argas persicus).



A. B.

PLATE 230.—THE POULTRY TICK (*Argas persicus*) (A) and (B).
A.—Male. B.—Female.

Description.

This is a flat, oval, brownish tick about one-quarter to half an inch in length. The mouthparts are situated ventrally between the front legs, and it is only by turning the tick on its back that these can be seen. It is a powerful bloodsucker, and, like the bed bug, feeds only at night, remaining hidden in cracks and crevices in the fowlhouse during the day.

Life History.

The female tick may lay 500 to 900 eggs during her lifetime, in several batches. These eggs are deposited in sheltered positions, and under favourable conditions may hatch in about ten to fifteen days. The tiny tick that emerges from the egg has only three pairs of legs, and almost immediately after hatching attaches itself to the fowl, preferring the skin on the breast, under the wing, and on the thighs for this purpose. In three to ten days' time it is fully engorged with blood, and, leaving the fowl, seeks a suitable hiding-place, in which it casts the skin, to appear as an eight-legged nymph. There are two further moults before the adult stage is reached, but, like the adult, these nymphal stages feed only at night.

Effect on the Fowl.

When ticks are numerous, their bloodsucking habits result in distinct injury to the birds attacked. This is due to the amount of blood sucked up by the ticks and to poisonous substances injected whilst feeding. Young chickens are most seriously affected, and the weakness caused by the tick may often be fatal.

The fowl tick is also very important, as it is the carrier of an organism which is responsible for fowl tick fever, which is a serious, and usually fatal, disease among fowls.

Control.

This tick is a very difficult pest to deal with, as not only is it resistant to ordinary insecticides, but its habit of hiding in deep cracks, &c., protects it to a very large extent from any spray treatment. A badly infested fowlhouse, if of little value, should be burnt as it stands. As adult ticks are able to live as long as four years in an empty fowlhouse, it is of little use excluding the fowls for any length of time as a control measure.

Crude oil makes a satisfactory spray, and should be forced well into all cracks and crevices, &c. Before spraying, all litter, nesting straw, and loose boards likely to protect the ticks should be removed and burnt. The spraying treatment should be repeated every three to four weeks until no more ticks are seen.

In addition to spraying, fowls may be protected from the ticks if the perches are so arranged as not to touch the fowlhouse walls. They may be swung from the roof on wires or else placed on supports rising from the floor. The perches should be frequently painted with crude oil. Nesting boxes, moreover, should be placed well away from the roosts, and are best constructed of metal.

Special coops should be set aside so that any bought fowls may be quarantined as a precaution against bringing in fresh infestations. The period spent in these coops should be about twelve days, and the coops should be kept thoroughly clean and well sprayed.

LICE.

The lice found on the domestic fowl are all biting lice, and there are at least six species occurring on fowls in Queensland. These various species are given popular names according to the part of the body or feathers on which they are most frequently found—namely, wing lice, head lice, body lice, shaft lice, and fluff lice. The various species are illustrated in Plate 231, figs. 1-6.

Lice infestation is most serious among chickens, and the irritation resulting from their presence may sometimes be fatal. Among grown fowls lice infestation is shown mainly by a decreased egg production.

POULTRY LICE.

Description of Plate 231.

Fig. 1.—Wing Louse (*Lipeurus caponis L.*) × 24.
Fig. 2.—Fluff Louse (*Goniocotes hologaster* Nitzsch) × 24.
Fig. 3.—Slender Pigeon Louse (*Columbicola columbiæ L.*) × 24.
Fig. 4.—Head Louse (*Lipeurus heterographus* Nitzsch) × 24.
Fig. 5.—Body Louse (*Eomenocanthus stramineus* Nitzsch) × 24.
Fig. 6.—Shaft Louse (*Menopon gallinæ L.*) × 24.

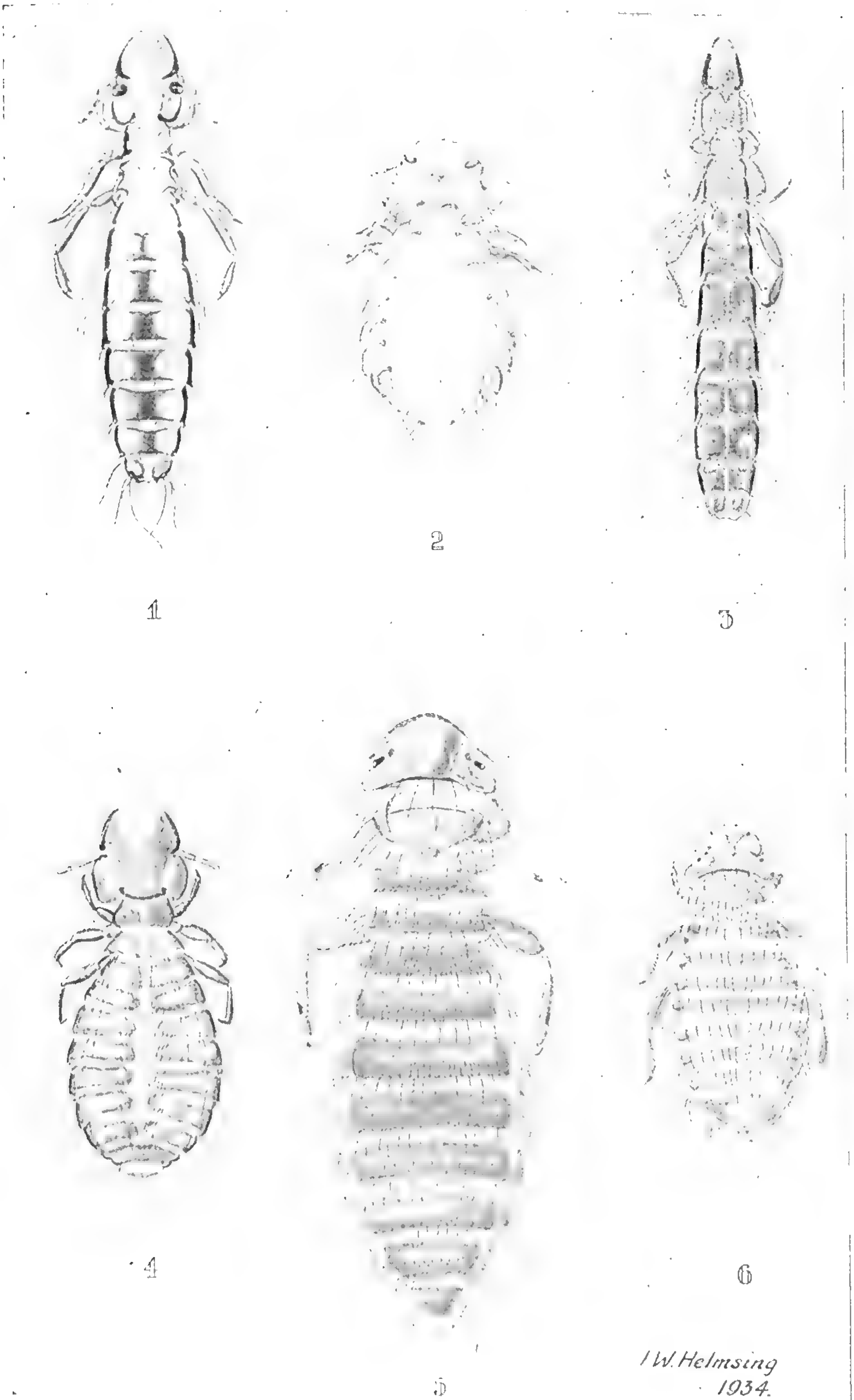


PLATE 231.—POULTRY LICE.
(*For description of Plate see page 562.*)

The two most important lice are the head louse, *Lipeurus heterographus* (Plate 231, fig. 4), and the body louse, *Eomenocanthus stramineus* (Plate 231, fig. 6). The former occurs in the region of the head, and is distinctly injurious to young chicks, and on occasions even to grown fowls. The body louse occurs mainly on grown fowls and causes serious irritation, resulting in unthriftiness and a marked decrease in the egg yield.

Control of Lice.

Lice may be best controlled with sodium fluoride, used either as a powder or as a dip, one treatment, if carefully carried out, being sufficient to kill all lice and their eggs.

Used as a powder, sodium fluoride may be applied in pinches to the base of the feathers in the region of the head, neck, back, breast, vent, wings, tail, and thighs, or it may be mixed with flour in the proportion of three parts of flour to one part of sodium fluoride and applied by means of a shaker.

Where large numbers of fowls are concerned, it may be considered more convenient to apply the sodium fluoride in the form of a dip, 1 oz. to each gallon of water. Only warm, sunny days should be chosen for dipping, and the fowl is plunged into the dip with the wings outspread. The fluid is then worked into the feathers with the fingers and the head ducked once or twice.

THE TROPICAL FOWL MITE (Liponyssus bursa).

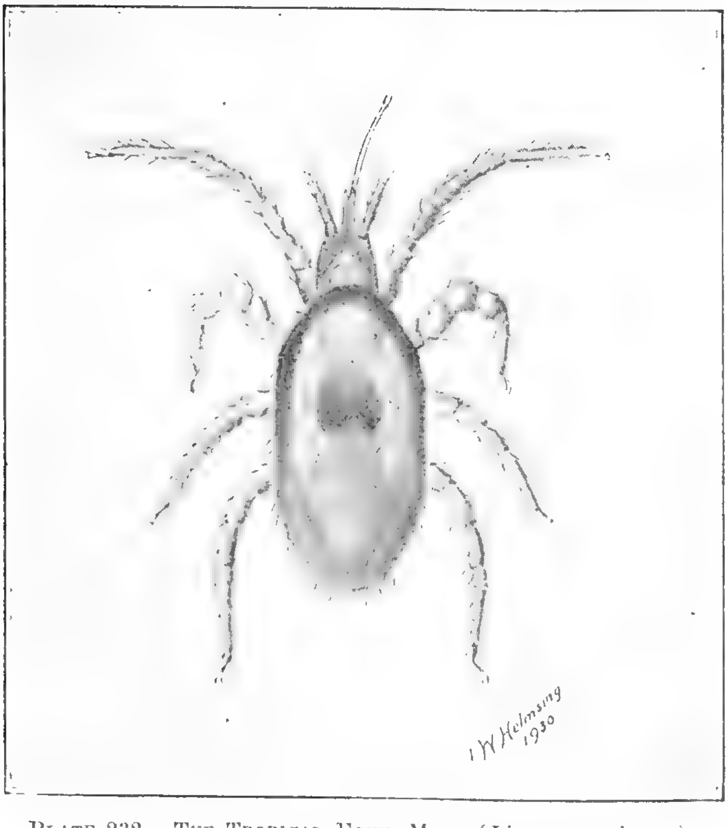


Plate 232.—The Tropical Fowl Mite (*Liponyssus bursa*).

This mite is very small in size, being no larger than a pin's head. It may be seen on poultry at any time during the day and night, and, owing to its bloodsucking habits, is distinctly injurious, especially to chickens and young poultry. Sitting hens may be so irritated by its presence as to leave the nest. On the fowl this mite occurs in greatest numbers below the vent, about the tail, and sometimes on the neck. A heavy infestation gives the feathers a dirty appearance, and the skin becomes irritated and scabby.

The female mite deposits her eggs among the feathers, where the young mites hatch and may complete their life cycle without leaving the fowl.

This is the species usually seen in fowlhouses in Queensland. When in numbers, the mites may crawl onto the arms, &c., of the poultryman, when handling infested fowls or nesting straw, and cause severe irritation. The tropical fowl mite may be transported by starlings, pigeons, and sparrows, and is also concerned with an infestation of houses, popularly held to be due to "starling lice."

Control.

Spraying with crude oil and the burning of all litter and nesting straw is advised. In addition, individual treatment of all fowls by dipping in a mixture of 1 gallon of water, 2 oz. of flowers of sulphur, and 1 oz. of soap is necessary, taking care to wet the feathers thoroughly. Alternatively, dusting with flowers of sulphur will be found satisfactory, but is not considered to be as efficient as dipping.

RED MITE (Dermanyssus gallinæ).

This mite is very similar to the tropical fowl mite in appearance, but, like the poultry tick, feeds only at night, and, with few exceptions—for example, in the case of sitting hens—is not found on the birds during the day. The red mite is also a bloodsucker, and when in numbers may be regarded as a serious parasite. Its eggs are laid in the cracks and crevices in which it hides by day.

Control.

Red mite control may be accomplished by spraying with crude oil and the destruction of all litter. Dipping in this case is not required. Spraying should be repeated every three days till no more mites are seen.

SCALY-LEG MITE (Cnemidocoptes mutans).

This itch mite, as its name implies, is responsible for a condition among poultry known as scaly-leg. Mite attack is usually confined to the legs, though occasionally it has been known to include the comb and wattles. The mites, burrowing in beneath the scales, cause the formation of large crusts. They usually commence their attack between the toes, and gradually extend up the unfeathered portion of the leg. In severe cases the birds become lame and walk with difficulty, and, being unable to scratch, may rapidly lose condition.

Control.

The mites spread mainly by contact or from the perches, so no hesitation should be shown in treating affected fowls. An effective remedy is crude oil, into which the legs are dipped and washed with

a hard brush. The treatment should be repeated after thirty days. The perches should also be painted with crude oil.

DEPLUMING MITE (Cnemidocoptes gallinæ).

This mite lives at the base of the feathers and causes an intense itching, as a result of which the affected bird pulls out the feathers. If the stumps of the feathers are examined, they will be found surrounded with scales and crusts, whose presence distinguishes depluming mite infestation from moulting or the vice of feather-picking.

Control.

Dipping in the mixtures used for tropical fowl mite control is recommended.

INTERNAL PARASITES.

Flukes, tapeworms, and roundworms occur in the domestic fowl, but in Queensland fluke infestation is as yet unknown.

TAPEWORMS.

PLATE 233.
Different species of Tapeworms which are found in the fowl. (Natural size.)

Fowls in this State are infested with at least six distinct species of tapeworms, all of which occur in the intestine. The smallest of these, *Davainea proglottina,* is only about one-eighth of an inch in length, and is regarded as one of the most harmful tapeworms infesting the fowl. It occurs in the immediate anterior portion of the intestine, and requires various species of slugs in which to undergo part of its life cycle.

The largest tapeworm, *Davainea tetragona,* occurs in the lower portions of the intestine and may grow up to 10 inches in length. This species must undergo development in the housefly before its life cycle can be completed.

The other tapeworms infesting the fowl use various species of beetles, earthworms, and grasshoppers as intermediate hosts.

Effect of Tapeworm Infestation on the Fowl.

Heavy infestations are associated with loss of weight, diarrhœa, unthriftiness, and a decreased egg production, young fowls being most seriously affected. Some species, particularly *Davainea proglottina,* are considered by some authorities to cause leg weakness and leg paralysis.

Control.

The most efficient drug for the removal of tapeworms is Kamala. The dose for an adult bird is 1 gram, which should be reduced accordingly for younger birds and in cases of weakness. It is always best to treat individual birds and not attempt to give a mass treatment by mixing the drug with the food. No previous starvation is necessary. To be on the safe side, a few birds only should be treated at first and carefully watched for any ill-effects.

As poultry tapeworms require an intermediate host to complete their life cycle, and as these several intermediate hosts must come into contact with the dung before they become infected, the first step in prevention consists of the regular removal of all droppings and their safe disposal. The droppings should be either burnt or else treated with a strong disinfectant and buried. All litter which provides hiding-places for the beetles, &c., should be destroyed and everything possible done to do away with conditions favourable to the breeding of these intermediate hosts. Boards, stones, &c., are shelter for slugs and should be cleared away. Dampness is another factor favouring some of these intermediate hosts.

ROUNDWORMS.

Several species of roundworms occur in the domestic fowl, the majority of which are found in the alimentary canal.

THE LARGE ROUNDWORM (Ascaridia lineata).

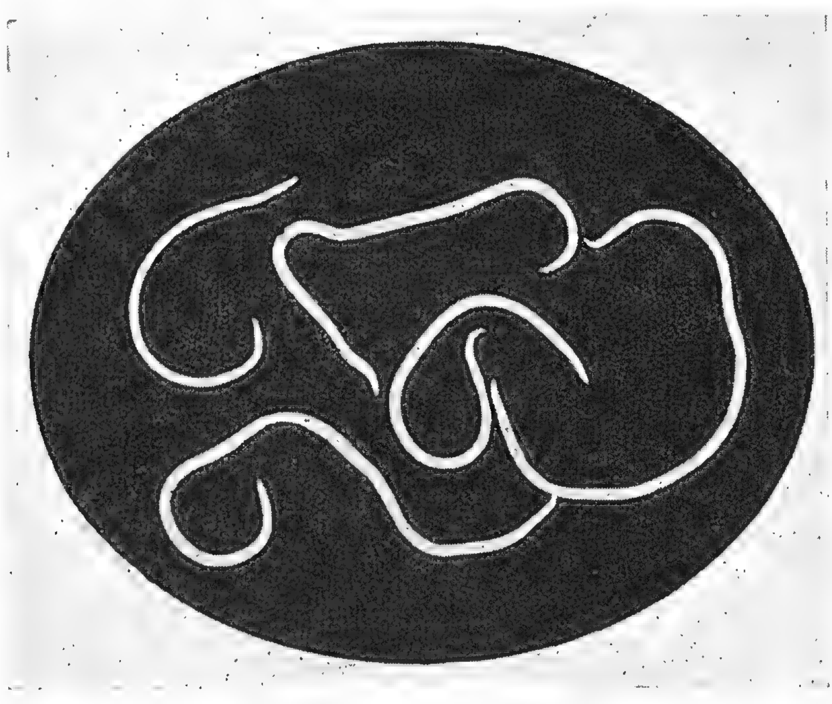


Plate 234.—The Large Roundworm (*Ascaridia lineata*). (Natural size.)

This species is one of the commonest worms infesting the domestic fowl in Queensland. It is found in the small intestine, and may reach a length of $4\frac{1}{2}$ inches, often occurring in very large numbers.

Young fowls are most seriously affected by this roundworm, and infestations stunt the growth and cause such weakness that mortalities frequently occur. Older fowls are not affected to the same extent, but a heavy infection may produce an unthrifty condition and a markedly decreased egg yield.

Life History.

The eggs are passed out in the droppings and under favourable conditions become infective in ten to sixteen days. These eggs, when swallowed by the fowl, hatch in the small intestine, and the young larvæ shortly afterwards penetrate the intestinal wall. Here they remain for about seventeen days, after which they make their way back into the intestine again and grow to maturity, which is reached in about fifty days after the eggs are swallowed.

Control.

The most effective treatment for the removal of this roundworm is the individual dosing of each bird with tetrachlorethylene or carbon-tetrachloride. These drugs may be administered in capsules. The adult dose is 1 cubic centimetre, which must be reduced accordingly in the case of young birds. Care must be taken that the capsules do not break during treatment, as the drug might enter the lungs with fatal results.

Many farmers regard individual treatment as impracticable, and for these the following mass treatments are recommended:—

1. Add to the mash for a period of three weeks 2 per cent. by weight of tobacco dust containing 2 per cent. nicotine. At the end of each week and at the termination of the three-weekly period Epsom salts should be given at the rate of 1 oz. in each gallon of drinking water.

2. Oil of chenopodium may be given after starvation for about eighteen hours in a wet mash at the rate of 1 teaspoonful for every twelve birds. For best results the treatment should be repeated after fourteen days.

Prevention is an extremely important factor in the control of the large roundworm, more especially as treatment is regarded by many authorities as having a serious effect upon the egg production.

The eggs of this parasite are thick-shelled and so resistant to adverse circumstances that in heavily infested flocks the birds are no sooner treated than they become infested again from the contaminated soil of the runs.

Strict sanitation is essential, and the removal of all droppings should be prompt and regular. Enclosed poultry-houses are best kept clean if provided with concrete floors. Special runs should be retained for the use of the chickens. New land is preferable for these runs, but if such is not available, old runs may be prepared by removing the top 6 inches of soil and replacing it with fresh, clean soil.

SLENDER INTESTINAL WORM (Capillaria retusa).

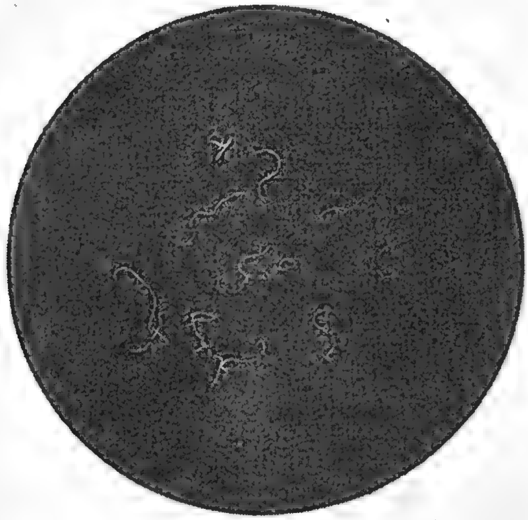


Plate 235.—Slender Intestinal Worm (*Capillaria retusa*). (Natural size.)

This species is a hairlike worm, so slender that it may be easily overlooked by the naked eye, and is found in the small intestine. It is sometimes found in immense numbers, and in such cases may seriously affect the health of the fowl.

The life history is a direct one, somewhat similar to that of the large roundworm, though in the case of the slender intestinal worm, the larva is not known to penetrate the intestinal wall.

Individual treatment of each bird with carbontetrachloride or tetrachlorethylene is recommended to obtain the best results, though probably mass treatment as advised for the large roundworm may be expected to give some relief. The measures advised for this species to prevent reinfestation should also be adopted.

CÆCUM WORM (Heterakis gallinæ).

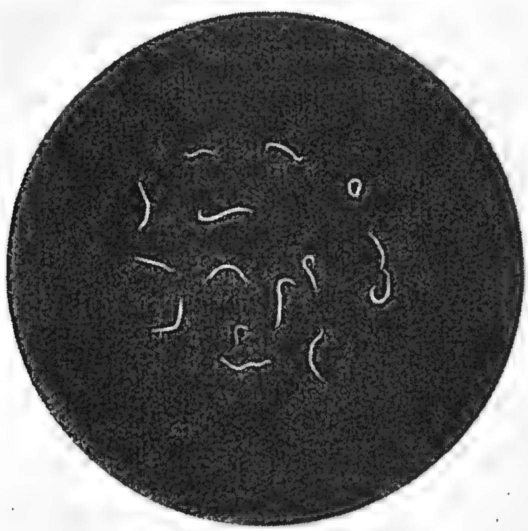


Plate 236.—Cæcum Worm (*Heterakis gallinæ*). (Natural size.)

The cæcum worm is an extremely common parasite of the fowl, and is found in the cæcum or blind gut. This is a whitish species growing up to half an inch in length.

Under favourable conditions these roundworms may be present in large numbers in the cæca, sometimes causing, especially in young birds, a serious inflammatory condition of the cæcal walls.

Life History.

The eggs reach the soil in the droppings of infested birds, where under suitable conditions of temperature and moisture they may become infective in fourteen to seventeen days. When swallowed by the fowl, these infective eggs hatch in the small intestine. The tiny larvæ hatching from the eggs make their way to the cæca or blind gut, and in about twenty-four days are fully grown. It was once considered that these larvæ penetrated the cæcal walls, causing the formation of nodules, but recent work has shown that at no time do they leave the lumen of this or any other portion of the alimentary canal.

Control.

The tobacco dust treatment as recommended for the large roundworm is stated to be effective if continued for one month. The preventive measures as advised for this parasite are also recommended.

STOMACH WORM (Dispharynx spiralis).

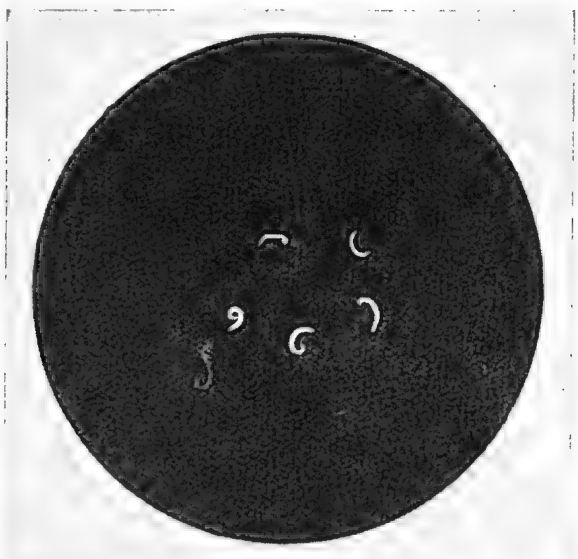


PLATE 237.—STOMACH WORM (*Dispharynx spiralis*). (Natural size.)

This species is a short, twisted worm, which occurs in the glandular stomach. It is not regarded as a very common parasite, but heavy infestations have been known to occur. When in large numbers, these worms may destroy the glands of the stomach, and in such instances infested birds, while maintaining a ravenous appetite, rapidly lose condition and may die.

Life History.

This stomach worm requires an intermediate host to complete its life history, and this role is played by the small, greyish, many-legged insect-like animals, known as wood lice or sow bugs. These are very conspicuous in damp places, where shelter is provided by piles of litter, loose boards, &c.

Control.

No satisfactory treatment is known, though the individual treatment as advised for the large roundworm should be tried. Strict sanitation must be enforced to prevent infection, and everything possible done to eliminate the presence of sow bugs on the runs, which may best be accomplished by keeping the place free of litter of all types.

GIZZARD WORM (Cheilospirura hamulosa).

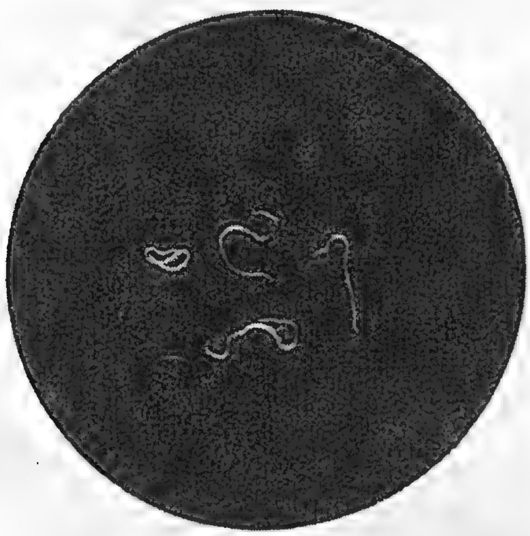


PLATE 238.—GIZZARD WORM (*Cheilospirura hamulosa*). (Natural size.)

If a gizzard infested with this roundworm is examined, numerous perforations and brownish areas may be detected on the horny lining. On stripping this lining, burrows will be seen in the muscle wall thus exposed, from which a portion of the worm may be protruding. These worms may grow up to three-quarters of an inch in length and, owing to their burrowing activities in the muscle wall, seriously interfere with the health of the fowl.

Life History.

In this case various species of grasshoppers must be present for the worm to undergo portion of its life cycle, the fowl becoming infected only when it eats these insects.

Control.

There is no treatment known, and control is entirely dependent upon the prompt removal of the droppings and their disposal so that they are not available to the intermediate host.

EYE WORM (Oxyspirura parvovum).

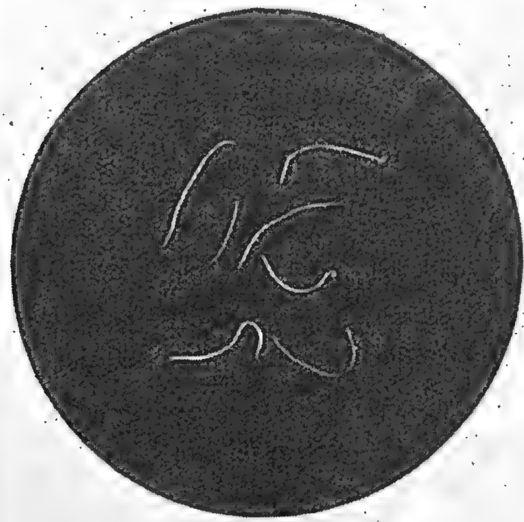


PLATE 239.—EYE WORM (*Oxyspirura parvovum*). (Natural size.)

The poultry eye worm is of interest only to poultry-keepers in North Queensland, as it is unknown south of Rockhampton.

This roundworm may grow up to three-quarters of an inch in length, and is found under the nictitating membrane* of the eye.

The presence of the eye worm causes irritation and inflammation of the eye, to relieve which infested fowls rub the eye against the wing or some other convenient part of the body, and may even scratch the eye with the foot. The eyelids may become inflamed and swollen, and there is a discharge from the eyes and nostrils. The sight is impaired, and if the infestation is not relieved blindness may result.

Life History.

The eggs laid by the female worms in the eye pass down the tear ducts into the throat, are swallowed, and eventually reach the exterior in the droppings. In time young worms hatch out, but before they can become infective to the fowl must be eaten by a species of cockroach. After a period of development in the cockroach, the young worms are ready to infest the fowl, which occurs when the cockroach is eaten. The worms free themselves from their insect host in the mouth of the bird and, passing up the tear ducts, reach the eyes.

Control.

For the removal of the worms from the eyes, a few drops of turpentine are placed in the eye and allowed to act for half an hour. The eyes are then washed in lukewarm boracic water and the worms removed with a camel-hair brush.

Prevention consists in the regular removal of all droppings and the elimination of all litter, &c., likely to provide hiding-places for cockroaches. The use of a good disinfectant as a spray will be found advantageous.

* The nictitating membrane is the thin membrane which passes over the eye when the fowl blinks.

Balanitis in Sheep.

By K. S. McINTOSH, B.V.Sc., H.D.A., Government Veterinary Surgeon.

BALANITIS or "pizzle disease" commonly occurs amongst wethers, and is occasionally seen in rams. It is an inflammation of the sheath or prepuce with the formation of pus. Although non-contagious, it is not uncommon for a large number of sheep to be affected at the same time.

Cause.

To appreciate the cause of balanitis, it is necessary to know something of the anatomy of the part. The penis or pizzle of the sheep extends forwards along the belly to a point just behind the navel, where it ends in a worm-like or vermiform appendage. The free portion is encased in the sheath or prepuce, which is actually an inward fold of skin, being continuous with the skin of the penis. The interior of the prepuce is lined with a modified type of of skin, which does not bear wool or hairs, but has sebaceous glands which secrete a cheesy yolk-like substance. The opening of the prepuce is also situated a little behind the navel, and it is through this opening that the urine pours after emission from the penis.

As the urine of sheep is alkaline, it often contains a fair amount of gritty insoluble substance. When this is passed with the urine it mixes with the sebaceous material, and forms a tough, gritty mass in the prepuce, particularly near the end of the penis. This sets up a marked irritation of the parts, which in many cases is followed by the formation of pus, with swelling and inflammation.

In the case of rams, the penis is frequently protruded, and thus the deposit is not allowed to accumulate, but in wethers and young rams the penis is never protruded, and thus they urinate into the sheath. This is the reason why the disease is more prevelant in wethers and young rams.

If a tuft of wool is left at the opening at shearing time it forms an excellent site for the accumulation of grit and sebaceous material, and when cut with the blades one can feel the grit in the wool.

Removal of the long hairs at the opening during shearing is also a predisposing cause, as these hairs assist in the draining away of urine. Sometimes grass seeds will cause pizzle disease by penetrating the sheath or its opening and setting up pus formation.

Diagnosis and Course of the Disease.

Owing to irritation and pain the sheep becomes uneasy and frequently kicks at the belly as if fly-struck. Sometimes sheep will be seen attempting to bite the pizzle, or they may rub it on stumps, &c.

If left untreated the affected parts swell till finally the animal is unable to urinate. At this stage one of two things may happen: Firstly, the sheep may die owing to retention of urine; secondly, there may be gangrene and sloughing of portion of the affected part, and the sheep will urinate through an opening in the prepuce caused by the slough.

The condition is often accompanied by fly strike.

The sheep falls away in condition, and if treatment is not commenced in the early stages there may be appreciable losses.

Treatment.

In the very early stages the disease may be treated by "ringing" the "pizzle," squeezing out the pus, and syringing the sheath with a lysol solution at the strength of one dessertspoonful to a pint of water. After this the sheath should be syringed every three or four days with a 2 per cent. solution of bluestone (copper sulphate).

In more advanced cases one has to slit open the sheath. This is most conveniently done with a long pair of scissors with one blunt point. The blunt (or ball) pointed blade is passed into the opening, and the prepuce cut open. Using a clean piece of rag and lysol solution, the pus, &c., is then cleaned away and the part washed. The wound must then be treated every two or three days till healed.

Between treatments the sheep should be placed in a well-grassed paddock.

Remember that the object of treatment is to clean away pus and dirt, and that cleanliness must be kept in mind throughout treatment.

Do not be in a hurry to open the prepuce of all sheep, but if they are not badly affected, try syringing first.

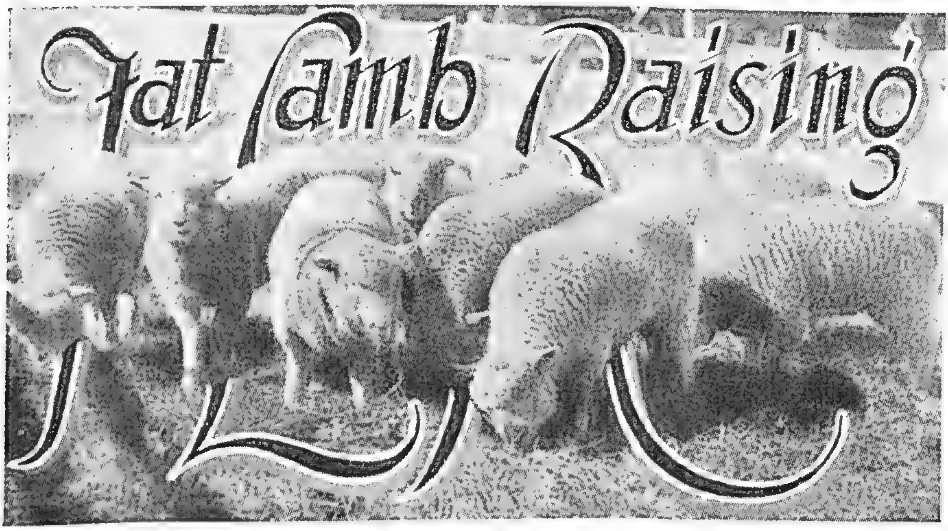
TO NEW SUBSCRIBERS.

New subscribers to the Journal are asked to write their names legibly on their order forms. The best way is to print your surname and full christian names in block letters, so that there shall be no possibility of mistake.

When names are not written plainly it involves much tedious labour and loss of valuable time in checking electoral rolls, directories, and other references. This should be quite unnecessary.

Some new subscribers write their surname only, and this lack of thought leads often to confusion, especially when there are other subscribers of the same surname in the same district.

Everything possible is done to ensure delivery of the Journal, and new subscribers would help us greatly by observing the simple rule suggested, and thus reduce the risk of error in names and postal addresses to a minimum.



By JAS. CAREW.

FAT-LAMB raising should form part of the routine farming in parts of Queensland, where the cultivation of a variety of fodder crops and grain can be carried on successfully. This industry has never been carried on in a general way in Queensland, and only a few Darling Downs farmers have continued it over lengthy periods. Where the correct breed and type were used, good lambs have been produced and sent forward, and some of the lambs shown at the Brisbane Exhibition were prime for export. That many lambs sold in our markets are not prime for export is, however, a well-known fact, but this can hardly be otherwise when such a large percentage of them are pure Merino. Should we wish to develop successfully this important section of the sheep industry, it will be necessary to give full consideration to breeding, feeding, and marketing. We must be influenced in the breed we select by the demand for the dressed lamb in our most important markets, as well as by the influence of our local conditions in producing them.

The Importance of the Dam.

The type of breeding ewe is important, and must be considered from several aspects. The ideal for the purpose is the large-framed, roomy ewe, productive in milk and wool, that will give a high percentage of lambs, and, if possible, mate at suitable seasons of the year. This type is difficult to obtain, with the result that a beginning must be made with the best that are offering.

As a mother for raising fat lambs, the pure-bred Merino cannot be regarded to be as satisfactory in a general way as crossbreds or comebacks. Merinos are more careless as mothers, giving a smaller milk supply; besides, they do not fit in so conveniently in mixed farming practice. They do, however, compensate somewhat for these disadvantages, in so much as they will mate successfully both in spring and

autumn. Ewes of the British Long-wool-Merino cross mate more successfully in the autumn, and as the best price is usually obtained for the lamb that is fit for slaughter in August, September, and early October, the Merino will secure this advantage; but it should be of the strong robust Western type. The value of the Merino covering must also be taken into account, while their condition remains more in keeping with requirements for breeding purposes.

The half-bred Downs Merino ewe will also mate successfully in the early summer, as well as in the autumn; and on this account is deserving of consideration, for a high percentage of lambs can usually be expected. Here, again, another disadvantage is introduced, for in good seasons the ewes not carrying lambs are inclined to develop too much condition, while at all times they do not carry a profitable fleece.

A Suitable Cross.

By crossing the Lincoln, Romney Marsh, English Leicester, or Border Leicester with the Merino, a most suitable type of ewe will be secured for autumn mating.

Preference may be given to the Romney Marsh cross for the lower and damper country, and to the Border Leicester cross for the higher or plateau areas like the Darling Downs.

These crosses produce a good lengthy fleece of wool, which usually meets with a good demand. They come to maturity fairly early, are good milk-producers, easily handled, and when mated to a quick-maturing breed of ram, the lamb should be sold off the teat, provided suitable food is available.

Export Trade Requirements.

To obtain best results for export lambs, evenness of type must be produced; and as the sires have the greater influence in this respect, we should choose that which is most likely to meet the demand. At the present time, the lamb most eagerly sought after is that weighing from 32 to 30 lb., and even lower.

To meet this demand the Downs types are the most likely to show plumpness at this weight, which they should reach in three months under favourable conditions. Although this is the size and type to secure top prices, other carcasses of the larger type do not fall away to any great extent at price per lb., such as the longer carcass of a Romney Marsh or Border Leicester cross, which should dress 38 lb. at four and a-half months. Should the season be unfavourable and lambs require to be kept over, the value of the covering they produce has an important bearing on the business. To get best results it is necessary that all growers produce an even type for export, and these should carry a special brand or tag to indicate standard excellence. Here is a suitable suggestion for a brand:—Darling Downs, Queensland, or DD over Q, to indicate the early plump prime light weight; and ED over Q to indicate the English long-wool influence in the heavyweight lambs. Lambs over 38 lb. dressed weight are not in keen demand for export; therefore, the seasons and provision for fattening are important factors in successful fat-lamb raising.

Even when breeding on proper lines, the only way to secure and place prime lambs on the market is to give them a good start off and keep them going with plenty of good and suitable food right up to the time they are trucked for slaughter.

Suitable Fodder Crops.

To secure best results, the pasture must be good, succulent, and plentiful.

This is seldom present for sufficient duration in our forest country pastures, therefore we must associate fat-lamb raising with agriculture, or adapt the slogan "The lamb must follow the plough."

Crops must be timed for use in the fattening of lambs, which in turn is governed by the mating period. Full consideration must be given to all influences likely to have a bearing on the position. The class of crop suitable to the soil and conditions and the time of year must be taken into account.

If lucerne can be grown successfully, it will be found the best for the main supply for most of the year. It gives best results when associated with grass pasture, adding some grain when finishing off.

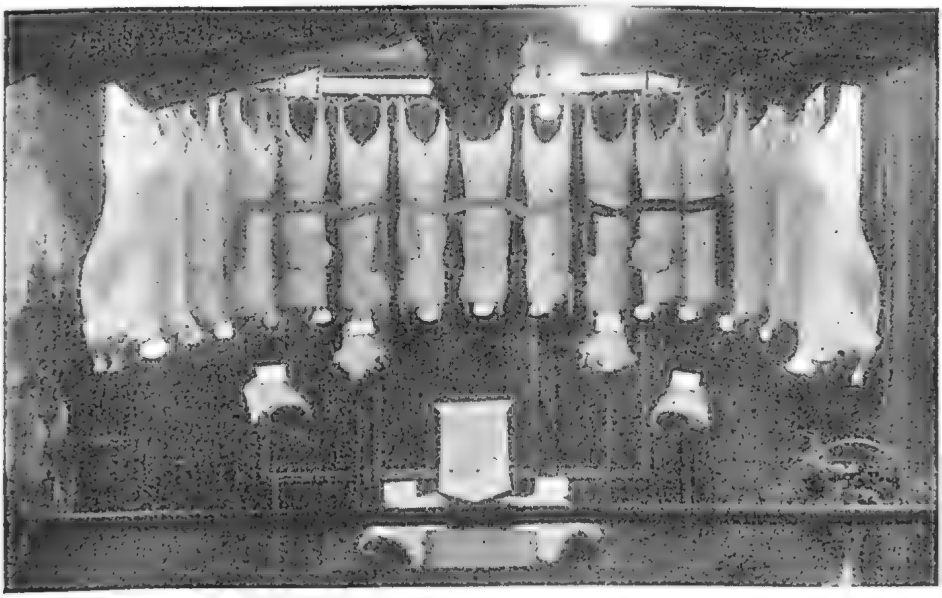


PLATE 240.—DISPLAY OF DARLING DOWNS LAMB CARCASES.
[*Block by courtesy of Queensland Meat Industry Board.*

Other crops suitable for given seasons are wheat, oats, barley, canary, rape, turnips, &c., for autumn sowing, and the panicums, millets, and Sudan grass for summer feeding and stacking.

When lambs are well fed and quickly fattened, they will be prime, plump, and sappy. In that condition they cannot be expected to stand up to hardship; therefore quick transport and immediate treatment at the works are two of the most important factors in avoiding serious loss of weight, and in maintaining the appearance of carcasses when dressed. If lambs on transport are to be man-handled, they should not be scruffed but lifted by securing a proper hold; any treatment likely to leave a bruise on the carcass should be avoided.

In obtaining the most satisfactory results, the co-operation of the Queensland Meat Industry Board and local agents is, no doubt, assured.

If numbers increase to anything near what Queensland is capable of producing, systematic forwarding will be necessary, and arrangements should be completed with the abattoirs before forwarding.

Preparation of Wool for Market.

TREATMENT OF BAGS AND BUTTS.

THE disposal of bags and butts is a problem that has always been in evidence, and even in the best of large clips the difficulty is encountered. Every broker at every sale has bags and butts which he wishes to sell to best advantage, and would be more satisfied without them. A duty to the client causes the broker to secure the highest possible price, but this is never likely to be in keeping with its true value, as the bags and butts are sought after by speculators only. As they are purchased for reclassing and reselling, it cannot be expected that their true value could be given, but rather that they be secured at the lowest possible price. Large owners are pleased to get rid of them with the least amount of trouble; therefore, when consigning their clip the bags and butts are included, except in cases where the odd lots are placed in bar bales. Bar bales are more objectionable to the broker than bags and butts; therefore, the difficulty is a real one. One of the most satisfactory methods would be to treat them on a large pooling floor where sufficient are put together to form bulk lines. This would be a distinct advantage to the small grower who does not grow sufficient wool to class it into bales, let alone bulk lines; while the large grower would also benefit. There is no question about the advantage of placing as much wool as possible on the market in bulk lines, and if not in bulk lines, then in bales. Bulk lines—five bales and over—are offered in the general catalogue and auctioned where all big buyers operate, while four bales and under are sold under star lot and competitive conditions, each system being distinct to the sale of bags and butts, which are really sold by barter.

In order to secure for all growers the best method of placing their wool on the market, the Department of Agriculture and Stock has so extended the conditions of the Farmers' Wool Scheme as to include—(*a*) wool from crossbred and British breeds from any holding; (*b*) bags and butts from any holding. This will allow that any grower may, with the consent of the owner, forward bags and butts for classification at the Departmental Wool Store.

With a view to securing an advantage for all wool-growers without causing an injustice to wool-brokers, it has been arranged that all brokers sell the wool from the scheme in turn. The drawing which the brokers themselves conducted recently resulted in the Queensland Primary Producers' Association, Limited, securing the agency for the season 1934-35. It now rests with the growers themselves as to whether they take advantage of the facilities that are placed at their disposal. The scheme is under the control of the Department of Agriculture and Stock, and the classing is carried out by qualified officers, while qualified accountants look after the bookkeeping part of the business.

Tuberculosis in Dairy Cattle and Pigs.

By J. C. J. MAUNDER, B.V.Sc.

THE influence of dairy cattle in the transmission of tuberculosis to pigs, resulting in partial and complete condemnations of carcases, is universally recognised. Much confusion seems to exist, however, concerning the relative importance of the various channels of infection.

The popular belief is undoubtedly that milk from infected cows fed to pigs is the most important source of infection. Actually, in conditions under which pig-raising is carried out in Queensland, milk infection is of minor importance compared to the degree of infection caused by ingestion of materials contaminated by dung of tuberculous cattle.

Consideration of the following facts will explain the relative importance of milk infection and infection from body excretions:—

It is well known that a cow with tuberculous lesions of the udder will excrete the organisms in the milk; in addition any tuberculous animal, though udder is healthy, is likely to intermittently excrete the bacillus in the milk. Personal observations obtained from tuberculin testing and post-morten examination of reactors has revealed the fact that the percentage of udder lesions is small, not exceeding 2 per cent. of tuberculous animals. Therefore, approximately 98 per cent. tuberculous animals merely excrete the organism in milk at irregular intervals, some infected animals never excreting the organism in the milk.

Before tuberculous infection becomes established in a pig repeated ingestion of infective material is necessary. Intermittent ingestion of organisms can usually be countered by the natural body defences, and possibly increases the resistance of the animal to the disease.

In considering the importance of excretion of the bacillus in the dung of tuberculous cattle, the following facts should be studied:—

(1) Infective sputum in cases of pulmonary tuberculosis is coughed up and swallowed by the beast, reaching the intestinal tract and being excreted in the dung, the organisms retaining their virulence.

(2) Bile of infected animals is often found to contain the bacillus, the source either being lesions of the liver or organisms in the blood stream eliminated through the liver and evacuated with the bile through the intestine.

(3) Intestinal and peritoneal lesions are responsible for the evacuation of bacilli in the dung.

When it is considered that the vast majority of cattle affected with tuberculosis have lesions in either lungs, lympathic glands, pleura, peritoneum, or liver, it will be realised that this group evacuating the bacillus in the dung must constitute a greater menace than the 2 per cent. of udder infections excreting the organisms in the milk. In addition to the presence of the tubercle bacillus in dung of affected animals the organism may be evacuated with the urine when lesions are present in kidney, pelvic lymphatic glands or genital organs.

Assuming then that dung of infected animals, or material contaminated with dung, and, to a lesser extent urine, constitutes a greater menace of tuberculous infection of pigs than the ingestion of milk from tuberculous animals, evidence is produced in support of the belief.

Investigation of properties from which pig condemnations have been heavy always reveals the fact that young pigs are allowed free access to areas soiled by droppings of dairy cattle.

One interesting case is quoted. A dairy farmer had for some years suffered heavy losses from pig condemnations. Assuming the source of infection was milk from tuberculous cows he decided to feed only thoroughly-boiled milk to his pigs. In the batches of pigs that had been fed only on boiled milk condemnations showed not the slightest diminution. Therefore, a definite source of infection existed apart from the milk supply. A survey of the herd was made, suspicious cattle destroyed, and methods adopted to ensure that young pigs were not allowed access to areas soiled by droppings from the dairy cattle. Milk was fed without boiling and the condemnations of these pigs were nil. This particular farmer has since adhered to the practice of enclosing of pigs with excellent results.

Another case is worthy of recording.

An owner conducted four farms, the cattle for the four farms being drawn from a common source. Careful periodical inspection and culling revealed that each herd contained from time to time tuberculous beasts. Hence, on each farm, there existed the danger that pigs would contract the infection. Actually, over a period of years, condemnations were always confined to one farm only, and investigation showed that this was the only farm on which pigs were allowed access to areas contaminated by droppings of dairy cattle. Examination of the cattle showed that the health of the cattle in the four herds was of an even standard.

It would appear, after consideration of the incidence of tuberculous lesions in various organs of dairy cattle and the means of excretion of the organisms, and field observations, that material contaminated by dung from tuberculous animals constitutes a greater menace to the health of pigs than does milk from infected cows.

In further consideration of the problem, the feeding habits of young pigs should be observed. Notice how the pigs roam around nosing under dried clumps of manure, seeking the small green shoots of grass and herbage. The tubercle bacillus present in the dung from affected cows has been existing under conditions ideal for the maintenance of its virulence, that is moisture and protection from light. There is, therefore, great danger of infection of scavenging pigs with virulent organisms.

When cattle have been fed on whole corn a proportion of the corn is passed out unchanged and forms a great attraction for the pigs. In picking out the grain from the manure there is great danger of infection with organisms excreted from a tuberculous beast. Young pigs having access to offal of animals slaughtered is also most undesirable, while the practice of slaughtering diseased cattle and feeding to the pigs is disastrous.

Methods of Dealing with the Problem of Condemnations in Pigs.

1. Where condemnations have been heavy over a long period, it is desirable to make a survey of the entire herd, selecting any suspicious beasts for the application of the tuberculin test. Selection of such beasts should be guided by the following clinical symptoms:—

(*a*) Deep distressing cough, sides heaving, tongue protruded.

(*b*) Difficult, snoring respiration.

(*c*) General delibity, staring coat, dull, sunken eye, the whole giving an impression of a sick animal, reluctant to move about.

(*d*) Enlarged lymphatic glands of head and neck, pre-scapular, pre-crural and mammary regions.

(*e*) Falling away in condition following calving.

(*f*) Large swellings in the udder, usually high up at the back.

(*g*) One or more quarters not functioning.

(*h*) Muco-purulent nasal discharge periodically expelled by violent snorting.

In addition to the above select the offspring of an animal known to have been tuberculous.

By the selection of cattle as outlined, submission to the tuberculin test, slaughter and burning of reactors the herd can be cleaned of animals most likely to have been the source of the trouble.

It is well known that cattle may be tuberculous to a considerable extent and exhibit no symptoms, and it is likely that such cattle would still remain in the herd after selection.

Infection from such cattle is effectively prevented by strict enclosure of young pigs from time of birth until marketed, thus preventing access to infective droppings and material contaminated by same.

2. Where it is not possible to have the tuberculin test applied, culling of animals exhibiting the symptoms outlined, and enclosure of pigs will yield good results. However, this method, i.e., dispersal with tuberculin test, is likely to result in culling of non-tuberculous animals.

3. Where condemnations are light, consisting chiefly of heads with only an occasional carcase, it will often be impossible to select any really suspicious beast that may be responsible. In such cases, excellent results are obtained by simply paying attention to the complete enclosure of the pigs.

4. Application of the tuberculin test to the entire herd with slaughter of reactors is the surest method of eliminating tuberculosis in the pigs. However, it is often impracticable to pursue this course on account of the severe economic loss that may be entailed. In addition some reacting animals with very light infection and not in any way responsible for transmission to pigs would be destroyed.

Occasionally the condemnation of carcases cannot be traced to the dairy cattle as the source of the tubercular infection. Under such circumstances the brood sows may be responsible, though actually such

is rarely the case. When brood sows are solely responsible for condemnations, it is not difficult to diagnose due to the fact that the sow will exhibit rather marked symptoms. Chief of these are swellings in the head and neck region, sometimes discharging; marked digestive disturbances leading to emaciation; short dry cough later becoming distressed with difficult breathing; swollen joints which may discharge cheesy purulent masses.

The mere fact that although sows are often suspected and slaughtered they are usually found to be healthy, rather supports the belief that the milk from the dairy herd is not responsible for tuberculosis of the young pigs. Should the milk be solely responsible for all the condemnations of pigs for tuberculosis, surely it is obvious that brood sows in piggeries suffering condemnations would, despite greater resistance due to age and repeated light infections that had been overcome, also contract the infection , and within a year or two the majority of brood sows would be suffering from advanced tuberculosis leading to occasional deaths.

One additional source of infection worthy of mention is the poultry.

Pigs are susceptible to the strain of the tubercle bacillus causing the disease in poultry, and it should be remembered that tuberculous poultry excreting in pig pens are capable of transmitting the infection to pigs.

Fortunately avian tuberculosis, as far as has been determined, is of rare occurrence in Queensland. Hence, this source of infection is not so important as in other countries.

Summary.

1. The source of practically all tuberculosis in pigs in Queensland is the dairy cow.

2. Infection of pigs takes place chiefly—

   (*a*) By ingestion of infective milk;

   (*b*) By ingestion of material contaminated by infective droppings.

3. Infection by ingestion of material contaminated by infective dung is of greatest importance under conditions of pig-raising usually practised in this State.

4. Attention to health of the cattle, and complete enclosure of pigs preventing danger of ingestion of contaminated material will result in the elimination of persistent condemnation of tubercular carcases.

Queensland Weeds.

By C. T. WHITE, Government Botanist.

KHAKI WEED (*Alternanthera repens.*).

PLATE 241.

Description.—A creeping perennial herb, rooting at the nodes, stems hairy. Leaves opposite in unequal pairs, the one being usually much larger than the other, averaging about 1 inch long and ¾ inch wide, broadly obovate (i.e., inversely egg-shaped) in outline, apex with a minute spicule, base tapering to a more or less slender leaf-stalk. Flowers borne in great abundance in numerous heads in the leaf-axils; each flower surrounded by sharply pointed bracts, the whole head ripening in seed into a spiny burr. Seeds enclosed in loose membranous, easily detached skin (pericarp), light-brown in colour, smooth, round and flat, about one-sixteenth of an inch in diameter.

Distribution.—A native of tropical and subtropical America, now a naturalised weed in many warm countries. It is one of the most troublesome weeds in Queensland. It is very abundant in South Africa, and is supposed to have been introduced there from the Argentine in fodder at the time of the Boer War. From South Africa it is thought to have come to Australia, but how it came here is not definitely known.

Botanical Name.—*Alternanthera,* referring to the fertile anthers in some species of the genus alternating with sterile ones (staminodia); *repens,* Latin meaning creeping.

Common Name.—Khaki Weed or Khaki Burr is the general name given to the weed both here and in South Africa. I have generally regarded the name to be derived from the prevailing colour of the plant, particularly when drying off. A South African writer says, however, that the popular name, at least in that country, is due to the plant's association with the Boer War.

Eradication.—In small areas Khaki Weed is best destroyed by hand-grubbing or chipping, but as it has the power of sending out roots from the joints, there is always the chance, unless the work is carried out in hot, dry weather, of the cut pieces growing again, so that the cut-up plants should be raked up and burnt. In 1918 an officer of the Department of Agriculture and Stock, Mr. F. B. Smith, B.Sc., Assistant Agricultural Chemist, visited Beaudesert to inquire into the destruction of Khaki Weed by chemical means, and reported that the weed was easily destroyed by common salt (butcher's salt, or any coarse, common waste salt) at the rate of 1–2 tons per acre. A weak arsenical solution containing 0·2 per cent. arsenic will also be found effective where the poisonous spray could be used. The value of salt as a weed destroyer lies in its property of absorbing moisture both from the soil and plant tissues, and so kills the plant by thirst; thus to prove effective, it should be applied in hot, dry weather.

Botanical References.—*Alternanthera repens* (L.) O. Kuntze. In a letter from the Director, Royal Botanic Gardens, Kew, England (Sir Arthur W. Hill) under date 10th July, 1934, the above is given as the correct name for the common Khaki Weed of Queensland, with the following as synonyms:—*Achyranthes repens,* Linn. Sp. Pl. 205; *Illecebrum achyrantha* Linn.; *Alternanthera achyrantha* R. Br.; *Alternanthera echinata* Smith.

Nutritive Value of Pastures.

By E. H. GURNEY, Agricultural Chemist.*

WHEN it is considered that the major portion of the world's animal products utilised by man is dependent upon pasture, the great value of scientific investigation dealing with all the factors concerned with the growth of pasture must be recognised.

The value of the practical application of information obtained from such investigations should then also be recognised.

Until the last few years the study of pasture, together with other animal foodstuffs, was directed to the determination of Starch Equivalents, or Calories, and the "protein ratio," but it is now known that, in addition to these factors, there are others which are necessary to successful animal growth.

It would appear that green pasture of good nutritional value is supplied with vitamins, but these few remarks are made more in connection with the proteid and mineral content of pastures growing under different conditions and at different stages of growth.

Mention may be made that the value and functions of the mineral matter contained in foodstuffs is now more fully understood, and it has been proved that a number of stock ailments are caused through some mineral deficiency or incorrect mineral proportions in the food consumed.

The fact that fairly young grass growth is more nutritious feed for stock than the older rank growth has always been accepted, and in older settled countries, where the method of laying down pastures, is followed to an extensive degree that this fact was not overlooked is evidenced by the common practice of making hay of the pastures before it reaches the rank matured stage.

GRASSLAND MANAGEMENT.

The modern system of grassland management, though it is stated to have its origin in Germany in 1899 (A. W. Greenhill Jour. Agri. Science Vol. 20), has only been followed in the British Empire during the last decade. The present intensive system of rotational grazing consists of feeding off young pasture continuously, which is produced by grazing paddocks in rotation.

It must be understood that system differs essentially from the method of turning stock into different paddocks for purpose of feeding off any excessive grass growth.

The method of rotational grazing, which will be mentioned again, cannot, of course, be applied to the large grazing areas of pastoral holdings of the western districts, but grass growth in small paddocks might be protected and these paddocks used as nursery paddocks.

For the purpose of making quick comparison, the composition of grasses is stated as percentage of the dry material contained in the grass and any percentages quoted will have been calculated upon "water

* In a broadcast address to farmers from Radio Station 4QG.

free material.'' Thus a pasture containing 75 per cent. moisture and 25 per cent. dry material in which is included 5 per cent. protein, this amount of protein in 100 per cent. of dry or ''water free material'' would be 20 per cent.

The relatively long spells of dry weather occurring through the year in our climate has a great influence upon the feed value of our pastures. Rain falling after a spell of dry weather causes a very rapid grass growth, particularly so under warm weather conditions. The young flush growth of uncultivated natural grasses in the large grazing areas is only eaten by stock to a more or less limited extent, and what is not grazed off very rapidly reaches maturity. The young grass has, in most cases, a high feed value, considered both from its protein and mineral content; the amount of these food constituents varying somewhat according to conditions under which the grass has grown. But in all cases the feed value of the young grass decreases as growth towards maturity proceeds, and when the grass has reached the roughage stage the feed value is generally of a very low order.

The following figures from analyses of samples of Mitchell grass at different stages of growth are quoted in illustration:—

ANALYSIS OF WATER-FREE MATERIAL.

——	Crude Protein.	Crude Fibre.	Lime (CaO).	Phosphoric Acid (P_2O_5).	——
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	
Mitchell Grass ..	18·8	27·6	1·09	0·507	Young and green, 12 in. long;
ditto ..	8·2	32·4	0·55	0·310	seed ripe and falling;
ditto ..	2·3	36·3	0·56	0·066	more or less roughage.

From these figures the very great difference in the nutritive value of the grass at different stages of growth is very apparent. It should be mentioned that the different grasses of the western country are supplemented in good seasons and on good country by herbage, some of which is of very good feed value.

In discussing the pasture of the southern coastal areas different conditions exist, for here it is possible to control, to a large extent, both the kind of grass growing and its nutritive value. The pasture of coastal districts is principally utilised by dairy stock.

EXPANSION OF DAIRYING.

The dairy industry is expanding and competition is such that it is necessary for dairy products to be obtained as economically—and continuously—as possible, and it is for this reason that pasture management is so extensively practised in countries where dairying is to any extent conducted. Very briefly stated, pasture management in the coastal districts may be said to consist of sowing suitable grasses for the laying down of a permanent pasture, or the renovation of an existing pasture, and where the pasture is established by either of the abovementioned procedures. The next and most important step in pasture management is to feed off the pasture when in its most nutritious stage of growth, namely, when it is young and succulent. The feeding off of only young grass growth is managed by having the pasture subdivided into paddocks of about 2 to 3 acres, and grazing off these paddocks in rotation. Fertilizers are applied to these pastures.

The following figures show the increased nutritional value of pasture that has had fertilizer—ammonium sulphate and superphosphate—applied compared with similar adjacent unfertilized pasture:—

——	Crude Protein.	Crude Fibre.	Lime (CaO).	Phosphoric Acid (P_2O_5).
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Fertilized Pasture ..	17·6	25·9	0·593	0·586
Untreated Pasture ..	7·6	27·2	0·421	0·253

These figures show definitely the improved nutritional value of pasture gained through the application of fertilizers. The above samples were grown in paddocks at Caboolture, but similar improvement in pasture value has been obtained where correct fertilizer application and pasture management has taken place. It may be mentioned that the application of superphosphate increases closer growth in the pasture, whilst the ammonium sulphate particularly benefits grass growth.

The growth of legumes such as clover in grass pastures increases the feed value of such pastures, as the legumes generally are richer in both protein and minerals, being particularly rich in lime, but grasses grown under good conditions and grazed at best period of their growth contain usually somewhat more phosphoric acid than the legumes. It would appear from this that to obtain the best results a certain balance of clover and grass is necessary in pasture.

It is not necessary to give any further examples showing the great difference in the nutritive value of young and matured pasture. The following will illustrate the value of correct grass management, a sample of paspalum pasture obtained at time stock were put on it contained the following in the water-free material:—

	Per cent.
Crude Protein	21·1
Crude Fibre	26·3
Lime (CaO)	0·416
Phosphoric Acid (P_2O_5)	0·616

Sixty-four pounds of this green paspalum would supply 2·2 lb.. of digestible crude protein, which amount is sufficient for a cow yielding 25 lb. milk of 3·5 per cent. fat; whereas 67 lb. paspalum at a stage of growth frequently fed to cows require the addition of lucerne chaff or concentrates in order to supply the 2·2 lb. of protein required as mentioned. It is cheaper to supply protein in grass than to buy concentrates for that purpose.

It is possible with suitable grasses and correct management of the grasses to supply high-feeding value material, when other food material is lacking, either by grazing, the grass, or by using the surplus grass of flush growth, which has been stored as hay or ensilage.

NUTRIENTS IN STOCK FOODS.

In considering stock foods it is convenient to classify the different food nutrients, and a brief classification is as follows:—

Proteins are nitrogenous bodies contained in foods, and are used in the animal body for the purpose of building up the flesh and muscle

and for repairing what may be termed the waste of these organs which is continually taking place.

Carbohydrates, including such substances as sugars, starches, cellulose (fibre). These substances are used by the animal for the purpose of supplying heat and energy.

Fats and oils are also used for supplying heat and energy.

Mineral Matter.—Vitamins: The proteins, carbohydrates and fats are termed the organic matter, and the mineral matter (ash) is termed the inorganic matter of foods. It is in connection with the mineral matter of foods that a few remarks will be made.

Some sixty years ago an investigator named Voit and others pointed out the necessity of having supply of mineral matter in rations for animals, but the importance of this matter was not recognised until a few years back. It is interesting to note that disease in stock has been an important factor in directing attention to the necessity of having suitable amounts of mineral matter in stock foods.

The mineral matter of plants and animal life is composed of similar elements as calcium, sodium, potassium, magnesium, iron, phosphorus, sulphur, chlorine, iodine, and also traces of other elements.

It has been proved that these mineral elements are necessary for animal life, and, therefore, if normal healthy life is to be maintained these substances must be contained in the food.

In the past it was assumed that any apparently nutritious ration would supply mineral matter which was thought was only needed to build the skeleton of the body, but it is now known that all rations do not necessarily supply the required amount or correct proportion of the different mineral ingredients. Also, it is now known that mineral matter besides being necessary for bone formation is also necessary for blood and other fluids of the body, and the normal functioning of the organs of the body.

Taking the milk of an animal as being the best guide as to what are correct mineral requirements of the young growing animal, in the case of cow's milk it is found that about half of the total mineral matter of the milk is composed of calcium phosphate (lime phosphate). Again the greater portion of the bones is composed of phosphate of lime. Therefore, the food for the young growing animal requires to be well supplied with lime and phosphoric acid. The adult animal requires relatively less than the growing animal, but these mineral ingredients must still be in sufficient quantity for maintenance requirements.

Then, in addition, the adult lactating animal requires in the food sufficient lime and phosphoric acid to make good the loss of these minerals in the milk produced, particularly are these minerals necessary in ration of heavy milking cows.

From what has been said it will be noted that phosphoric acid and lime are the mineral ingredients required in the largest quantities by stock. This fact is of particular importance in this country as the soil of a considerable portion of our grazing areas, also of some of the cultivated soils, are deficient in phosphoric acid. In a previous talk the much higher lime and phosphoric acid content of young pasture growth than when pasture was more matured was mentioned.

In connection with the average lime and phosphoric acid content of a few common foodstuffs, the following are mentioned:—

	Lime (CaO). Per cent.	Phosphoric Acid (P_2O_5). Per cent.
Lucerne Hay	2·0	0·56
Paspalum Hay	0·5	0·38
Cowpea Hay	2·3	0·50
Green Sorghum	0·2	0·12
Bran	0·09	3·00
Pollard	0·08	2·10
Maize	0·02	0·70
Cotton Seed Meal	0·36	2·60
Linseed Meal	0·50	1·70
Coconut Cake	0·32	0·94

From these analyses it will be seen that bran and maize have a relatively low lime content, but bran and maize, cotton-seel meal, linseed meal, and coconut cake have a high phosphoric acid content. The legumes, lucerne and cowpea, have a high lime content, but the phosphoric acid content is not as high as in the bran, &c.

The green sorghum, in comparison with the other mentioned foodstuffs, has a low lime and phosphoric acid content.

Generally pasture contains more lime than phosphoric acid, and, as mentioned before, owing to a deficiency of phosphoric acid in soils, there is frequently a decided deficiency of phosphoric acid in the grasses grazed; and, therefore, giving lime only to the animals will not remedy troubles cause by phosphoric acid deficiency and, in fact, will only exaggerate such troubles.

The depraved taste exhibited at times by cattle in the chewing of bones, &c., is certainly an indication of the want of some mineral matter not supplied by the food, and generally it is insufficient phosphoric acid. Of the elements mentioned as being present in plants potassium is usually present in ample amounts for stock requirements, and so far as investigations have gone there would appear to be no evidence of iodine deficiency. The same may be said about iron and sulphur, though these ingredients administered to stock in small amounts prove beneficial to stock.

The sodium and chlorine are contained in plant growth, but in addition these elements are given to stock by means of common salt. Now, because animals require and must have a certain amount of salt for maintaining the digestive and other processes of the body, a somewhat common belief with some stock feeders is that if salt is given to stock that is all that is necessary to supply to correct any mineral deficiency in the food consumed by their stock.

From the few previous statements made it is apparent that salt will not supply the phosphoric acid deficiency frequently existing in our pastures.

The means available by which sufficient amounts of phosphoric acid may be supplied to stock are possibly well known, but are certainly not always practised.

Such means are (1) by cultivating and fertilizing pasture and then feeding this pasture off in the young stages of growth; (2) including in a ration some ingredients containing a fair amount of phosphoric acid; (3) by supplying stock with a good phosphatic lick, that is a lick containing a fair amount of phosphoric acid, and not an excessive amount of salt.

Some Requirements of Plant Growth.

By E. H. GURNEY, Agricultural Chemist.*

THE food of plants is naturally the first requirement to be considered in connection with plant growth.

Plants are composed of many compounds, these compounds being built up with chemical elements. The following elements are found in plants:—Carbon, hydrogen, oxygen, nitrogen, phosphorus, sulphur, calcium, potassium, magnesium, iron, sodium, silicon, manganese. Other elements are found in plants, some of which are now also considered as possibly being essential to plant growth.

Water, in so far as quantity is concerned, is the most important factor in plant production. The amount of water which enters the roots of plants and transpired through the leaves during growth is enormous. The amount will be realised when it is stated that for every pound of dry material manufactured by plant processes, from 300 to 800 lb. of water have been required. Of course, this amount of water represents the water that has circulated continuously through the plant carrying fresh amounts of dissolved food from the soil to meet the needs of the growing plant. In different crops the water required to produce one pound of dry matter varies considerably, thus it is stated wheat requires 500 lb., oats 600 lb., and clover 800 lb. of water to produce 1 lb. of dry plant material. Though the amount of water in the plant at any one time is large compared with other material composing the plant, it is relatively small when compared with the amount of water transpired.

Briefly, we may consider the composition of some crop—paspalum, for example—Water, 75 per cent.; organic matter, 22 per cent.; ash, 3 per cent.

Now practically one-half of the organic matter of plants consists of carbon, the rest of the organic matter being composed mostly of oxygen and hydrogen, and a small amount of nitrogen—about 0·4 per cent. The plants by means of the green colouring matter—chlorophyll—in their leaves have the power in sunlight of assimilating the carbon contained in the carbonic acid of the air. The air contains on the average 0·033 per cent., or one hundred of 1 per cent. of carbonic acid gas, and it is certainly very wonderful that about one-half of the dry matter of all green plant growth and coal in the world is the result of the assimilation by chlorophyll mentioned above.

Essentials of Successful Plant Development.

With this brief review of plant composition consideration can be given to means that may be employed to enable plants to obtain the requirements necessary for their most successful growth.

Plant life is assisted in connection with carbon assimilation in being situated in locations which permit of their receiving suitable exposure to sunlight, and this is one of the reasons that certain situations are more suitable than others for some crops.

* In a broadcast address to farmers from Radio Station 4QG.

Here it may be mentioned that iron is necessary in plant life as it controls the formation of chlorophyll, and in some cases a deficiency of iron has caused a plant trouble termed "chlorosis." There is usually an abundant supply of iron in most soils, but in some cases where plant chlorosis has occurred owing to iron deficiency, the trouble has been rectified by the application of iron sulphate, either as a spray or to the soil.

Regarding the water requirement of plants, means are available for assisting plant growth in this requirement, and the first measure to be undertaken is to prepare the soil as far as possible into a suitable condition for the reception and retaining of rain. Rain falling upon a soil with its surface in a hard crust-like condition will be unable to penetrate the soil to the extent it would if soil surface was in a friable condition.

Some soils are able to retain the rain falling upon them better than others, and this is due to the fact that soils are composed of variable amounts of different materials. These various soil ingredients have very different power of absorbing and retaining water, thus soils having a high humus content and clayey soils have a much greater capacity of absorbing and retaining water than sandy soils. It has been found that a more or less pure sandy soil will only retain about 25 per cent. of its weight of water, whilst a sand clay may absorb as much as 50 per cent., and a soil with high humus content may absorb 85 per cent. or more.

It is considered that the most successful plant growth is obtained when the water content of the soil ranges from 40 to 50 per cent. of the total water-holding capacity of the soil.

Therefore, plants may be assisted in obtaining their suitable water requirements, first, by improving the condition of soil by converting it into a more open and friable condition by cultivation and liming, and in the second place by increasing the humus content of the soil.

Humus can be added to the soil by the addition of farmyard manure and by ploughing in green manure crops and all vegetable residues. In our climate, with at times long spells of dry weather, the necessity of increasing the humus content of soils for the purpose of retaining the soil moisture as long as possible is gradually becoming recognised, though not to the extent that its importance deserves, but as farmyard manure is not available in large quantity, the ploughing in of green manure crops should be a regular procedure in our cultural system.

It was mentioned that the organic matter of the paspalum contained a certain amount of nitrogen; similarly all plant life contains nitrogen, the percentage of nitrogen being much higher in the younger stages of plant growth than in the matured plant. Some plants contain more nitrogen than others. Thus leguminous crops have a high nitrogen content, and what is of particular importance is that the nitrogen of these crops is derived from the air, and thus the growth of a leguminous crop does not lessen the soil's nitrogen content, but increases it. This valuable property of the legumes is due to the fact that the various leguminous crops have different bacteria growing in "symbiosis" with them (symbiosis means the living together of two organisms for their mutual benefit).

The bacteria enter the roots of the plant, which results in the formation of nodules upon the roots, after which the bacteria obtaining energy from plant material converts the nitrogen of the air in the soil into compounds suitable for assimilation by the plant. For this reason legumes are particularly suitable as green manure crops, although other crop growths are valuable for this purpose.

Value of Humus.

It may again be stated that it is considered that in Queensland one very important means of maintaining the fertility of agricultural fields or garden plots is by the continued application of material capable of forming humus. That this application of humus may not supply all the mineral plant-food requirements is admitted, but humus in the soil assists in rendering more quickly available to plants the mineral plant-food applied by means of fertilisers. That mineral plant-food material is required by plants is shown by the composition of plant growth previously mentioned and is represented by the ash.

For the most successful plant growth there are requirements besides a sufficiency of moisture and plant foods. Some crops, such as clover, peas, cherries, thrive on soils that are not of an acid nature, whereas other crops such as maize have been grown successfully on soils having at least some degree of acidity. Again the different types of soils are more suitable for different plant growth, sandy loams being more suitable for root development of some crops than soils of a more clayey nature.

That crops have not made successful growth does not necessarily mean that some plant food is wanting or is in too small quantities, though this is very frequently assumed, whereas the real reason of poor growth may be that the type of soil is not suitable for the crop sown in it, or that the soil requires proper drainage, or that the soil has not a suitable aspect for the crop in question.

Therefore, in conclusion, it may be said for all crop requirements it is necessary to have all soil conditions such as tilth, available plant food, and soil bacterial population in good condition to satisfy their requirements.

FERTILIZERS AND MANURES.

Crops obtain their mineral plant-food requirements from the soil water. Cultivated soils usually contain abundance of plant food for many successive crops, with the possible exception of three or four substances—viz., nitrogen, phosphoric acid, potash, and lime. These substances in a fertile soil are not only present, but supplies are present in a form sufficiently available for the crop's need, whereas an infertile soil may contain the abovementioned food materials in a form unavailable to crops. Fertilizers and manures are applied to the soil to provide a certain amount of these plant foods to crops.

Fertilizers, often spoken of as artificial fertilizers, is the name given to what may be termed manufactured materials used for the purpose of supplying plant food to crops, and the term manure is more used in reference to such material as farmyard manure, guanos, and bulky organic material, which manures, it may be mentioned, improve the physical and biological conditions of the soils as well as supplying plant food.

Soils become depleted of some portion of their plant food by incorrect systems of cultivation; the supply of some particular plant food is exhausted before others. What particular plant food is required to be supplemented with application of fertilizer can be determined by experimental plots with crop it is intended to grow. Different crops require varying proportions of the different plant foods, some requiring larger amounts of nitrogen, others demand more phosphoric acid or potash.

The general effect upon plant life of the different ingredients in fertilizers should be considered.

Nitrogen stimulates the growth of the stems and foliage of plants, and if excessive amounts of nitrogen are applied, particularly if a deficiency of phosphoric acid and potash exists, very vigorous plant growth occurs, but with poor development of flowers and fruit.

Phosphoric acid promotes the growth of roots, increases crop yields, and accelerates the ripening and maturity of crops.

Potash seems to be connected with the formation of starch and sugar in plants, and in some cases with increased crop yield. Potash deficiency causes plant growth to be less resistant to diseases.

Lime improves soil tilth, renders some unavailable soil plant food to become available, causes conditions favourable for bacterial growth, and neutralises soil acidity. As in most soils there is sufficient lime for plant food requirements, lime is applied for the purposes just mentioned and not for plant food.

All plants make use of the same plant foods, but different plants require different proportions of these food ingredients.

These plant foods ingredients are contained in different commercial fertilizers. Among what may be termed simple (that is containing only one food ingredient) nitrogenous fertilizers are nitrate of soda, containing 15 per cent. nitrogen, ammonium sulphate, with 21 per cent. nitrogen. Both of these fertilizers being water-soluble are quick acting, the ammonium sulphate being somewhat slower than nitrate of soda. It is considered that plants when taking up nitrogen from the soil water assimilate the greater portion of their nitrogen in the form of nitrates, and, therefore, that the nitrogen in the ammonium sulphate is changed by reactions in the soil to the nitrate form before being utilised by the plant. Dried blood is another nitrogenous manure containing from 11 to 12 per cent. nitrogen. The nitrogen in this fertilizer is not so quickly available as the nitrogen in the two previously-mentioned fertilizers, still dried blood may be classed as a fairly quick-acting fertilizer.

Two simple phosphatic fertilizers are superphosphate and Nauru phosphate. Superphosphate containing from 20 to 21 per cent. phosphoric acid in a water soluble form is a quick-acting fertilizer, whereas Nauru phosphate containing from 37 to 38 per cent. of phosphoric acid in a form insoluble in water, is a slow-acting fertilizer, particularly if it is not ground to a fine state of division. In fact results from the application of Nauru phosphate are frequently not noticed during the first year, but appear in the second year.

Potash is contained in the two fertilizers sulphate and muriate of potash. Both these fertilizers being soluble in water are very quick

acting. The sulphate contains 48 per cent. and the muriate 50 per cent. potash.

Bonedust contains two fertilizing ingredients—viz., from about 3 to 4 per cent. nitrogen, and from 20 to 25 per cent. phosphoric acid. Meatworks fertilizer also contains from 3 to 7 per cent. nitrogen and from 14 to 20 per cent. phosphoric acid, and as these fertilizers have to be first decomposed in the soil their nitrogen and phosphoric acid only slowly become available.

Mixed or complete fertilizers, of which there are many upon the market, are those fertilizers which are manufactured by mixing any two or more simple fertilizers together. These complete fertilizers are known and sold under trade names or number, or with formulæ such as 6-14-10, which means the fertilizer contains 6 per cent. nitrogen, 14 per cent. phosphoric acid, and 10 per cent. potash, and another example 0-14-8 means that such a fertilizer contains no nitrogen, 14 per cent. phosphoric acid, and 8 per cent. potash.

POINTS IN FERTILIZING PRACTICE.

In connection with the fertilizers previously mentioned, it was stated that some were "quick acting" others again were "slow acting" and this difference in the time taken before the fertilizing ingredient is in a condition suitable for absorption by the plant is of particular practical value. In the case of crops that occupy the ground for more or less long periods it is advisable to apply fertilizers in which the fertilizing ingredients gradually become available to the plants, or under some soil conditions it may be advisable to apply a fertilizer in which portion of the ingredients are quickly available and the other portion slowly available. For crops that come quickly to maturity quick-acting fertilizers are required in order that a plentiful supply of available food is provided. Again it is frequently required that at some particular stage of growth the crops are advantageously stimulated by some quick-acting fertilizing ingredient, and hence the practice of top-dressings. A very good example of the stimulating effect of a quick-acting fertilizer is seen in the modern practice of pasture cultivation, in which at first the pasture is fertilized with ammonium sulphate and superphosphate either without or with potash, then throughout the season topdressing with ammonium sulphate results in very definite increased grass growth.

Another point in connection with fertilizers is that some crops respond better to their application when their fertilizing ingredient is of organic nature and not mineral. In applying fertilizers to pineapples it is generally stated that it is preferable to apply the nitrogen required in the organic form—viz., in blood and meatworks manure (blood and bone) and not in nitrate of soda (the mineral form). The nature of the fertilizing ingredients in the complete fertilizers sold can always be ascertained as it is stated in what form they exist—thus nitrogen as blood or as ammonium sulphate—phosphoric acid as bone or as superphosphate.

Lime, as stated before, is usually used for the purpose of improving tilth, neutralising acidity, and liberating otherwise insoluble plant foods. Lime can be used in different forms—viz., as quick lime, agricultural lime, and pulverised limestone. Quick lime is recommended for use on stiff, heavy soils, whilst the use of pulverised limestone is preferable on

lighter sandy soils with low humus content. The pulverised limestone to be effective must be in a very fine state of division. The degree of fineness is of importance in connection with such fertilizers as bone, Nauru phosphate, &c., for the finer the state of division of such fertilizers the quicker do they become available to plants.

It must be distinctly recognised that success from the application of fertilizers cannot be obtained, if the soil to which they are applied is in any manner of bad condition, such as bad tilth, poor drainage, or poor bacterial condition. This last condition is of particular importance in connection with the effect of fertilizers.

Fertilizers are always more effective if applied in conjunction with farmyard manure, even if with only small amounts of farmyard manure, as such manure encourages bacterial activity which in turn assists in converting more quickly the fertilizers into an available form for plants.

In connection with manures, such as farmyard manures, green manure crops, and composted vegetable matter, it may be said that they are used particularly for supplying humus to the soil and thus improving the physical and biological conditions of the soil, but such manures depending upon particular soil condition and crop requirement, may or may not be able to supply the particular amount of any mineral plant food required.

In connection with farmyard manure, it is considered that its importance is not properly recognised, as by not being collected and ploughed into the soil or stacked, a very great waste of valuable material results. The composition of farmyard manure varies considerably, but 1 ton of mixed farmyard manure contains from 450 to 700 lb. of organic matter, 10 to 15 lb. of nitrogen, 3 to 6 lb. of phosphoric acid, and from 8 to 16 lb. of potash. Then neglect of composting waste vegetable matter also ensures the loss of very valuable material which is of particular use in orchards and market gardens. Regarding green manure crops, the composition of which varies very much according to the kind of crop used, but, besides a very large amount of organic matter which such crops return to the soil it must be remembered that the plant food material contained in such crops is in a very available condition. Of course it must not be overlooked that these plant foods, with the exception of the bulk of the organic matter, are taken from the soil and thus do not correspond to the actual addition of chemical manure, but, as previously stated, are of great value as they are in a very available form. Thus the amount of material returned to the soil by ploughing in a crop of cowpea from one acre was—Organic matter, 5,462 lb.; nitrogen, 216 lb.; phosphoric acid, 61 lb.; potash, 123 lb.

EFFICIENT RAT TRAP.

An effective rat trap can be made from a kerosene tin. Cut the top away, and have about 6 inches of water in the bottom. Float chaff on the surface of the water so that the rats do not see it, and on the chaff rest the bait—something rather strong, such as a piece of old meat. Lean a plank against the side of the tin so that the rats can climb up to the top of the tin. One drowned rat does not prevent others from jumping in. It is possible to catch quite a number of rats in this way.

By E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

PART IV.

THE TAMWORTH.

THE introduction of the Tamworth breed into Australia dates back to near the end of the last century. George T. Chirnside, of Werribee Park, Victoria, was among the earliest importers, and the writer well remembers the time when Tamworths were first introduced to Hawkesbury Agricultural College stud, Richmond, N.S.W., by the presentation by Mr. Chirnside to the College stud of a very fine pair, the progeny of imported parents.

Of these animals, the boar "Cholderton King, 2," was the better, and was the second pig registered in this breed in Australia. That fine boar, "Knowle Indian Prince" (imp.) (1), and N.B. 14587, was the first; it was from the stud of Robert Ibbotson, of Knowle, Warwickshire, England—the most successful breeder, I believe, of Tamworths in England in his day. The Cholderton pigs were from the stud of H. C. Stephens, another well-known British breeder. The first pigs registered in the Australian Herd Book were those from the Hawkesbury College, followed by a team bred at Dunwich Benevolent Asylum, Queensland, and the progeny of a pair presented to Dunwich (Dr. Row was Medical Superintendent at the time) by the Principal (H. W. Potts) of Hawkesbury. The writer had the pleasure of crating and despatching this pair when he was Pig and Bacon Expert at Hawkesbury.

There has been a considerable improvement in type and conformation since those days; although all along it has been essential to discard the short-bodied, thick-set, "Berky" type of Tamworth, since the longer-bodied, more fleshy type is necessary to maintain true Tamworth quality and fleshiness.

In those days the Tamworth pigs bred on the Manning River, N.S.W., were among the best in the Commonwealth; such well-known breeders as the Birds, Martins, Murrays, among many others, being prominent advocates of this old-world breed. There were very few Tamworths in Victoria at that time and practically none at all in the other States except Queensland, where the breed has been in favour for forty years or more.

The breed was accepted for registration in the Berkshire and Yorkshire Society Stud Books in 1914, and, with the change of name to the Australian Stud Pig Breeders' Society, were likewise accepted. They are sponsored by the National Pig Breeders' Association in England and have a world-wide distribution.

Early History of the Tamworth.

The sandy red colour of the Tamworth pig evidences its descent from the old English breed, while its peculiar properties show that in purity of breeding it is second to none. The earliest records of the Tamworths show them to have been a very active race, and of great fecundity. Their fame as producers of lean bacon is historical. Of all the improved breeds the Tamworth existed longer in its natural state, depending chiefly on itself for its food; and it is to this, probably, that is due its persistence of type, safeguarded so jealously by the early breeders and later by Herd Book representation.

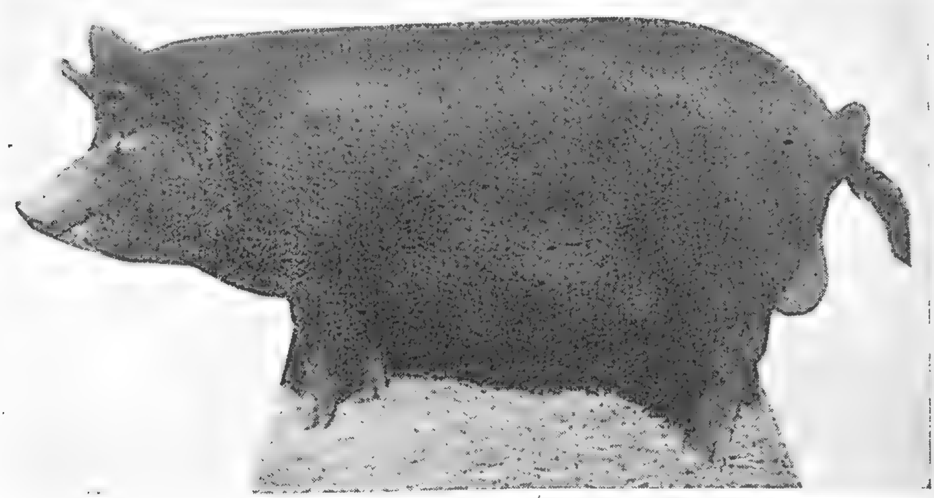


PLATE 242.

Length, depth, and quality are the outstanding features of "Wattledale Top," a championship winner in the Tamworth classes at many Queensland shows. Owned and exhibited by Mr. J. Barkle, "Wattledale," Kingaroy.

A century ago when landowners, farmers, hotel-keepers, cottagers, and others in a position to do so fed their pigs and cured their own bacon—supplying less fortunate neighbours with the unrequired surplus —the Tamworth was undoubtedly one of the most favoured breeds, owing to its ability to produce carcasses with the finest long sides of bacon and big hams.

As time went on bacon factories were established, and pig feeders discovered that fat from their pigs could be sold at an equally remunerative price to lean. It was then that the Neapolitan and other breeds carrying more fat were imported. This action undoubtedly depreciated the percentage of lean meat from the consumer's point of view to such an extent that, like a swing of the pendulum, reaction of vigorous nature has shown itself in recent years, and the demand in England is now for lighter weight bacon with a preponderance of lean meat. This swing over to lean meat and to smaller joints has been experienced also in

Australia, where at one time the very fat pig was highly prized and priced.

American pork and bacon, noted for a larger proportion of fat, and which at one time realised the highest price of all, does not now occupy the same prominent position on British markets.

Improvement in Type.

The present-day Tamworth is certainly a much improved pig to that bred a hundred years ago, this being attributable to the careful attention paid to selection and breeding in later years. It must not be assumed that the improvement has been assisted in any way by the admixture of foreign blood, for this is not so; Tamworths as such have been kept absolutely pure. Undoubtedly, this is one of the many reasons why they hold the position of being one of the finest bacon pigs extant.

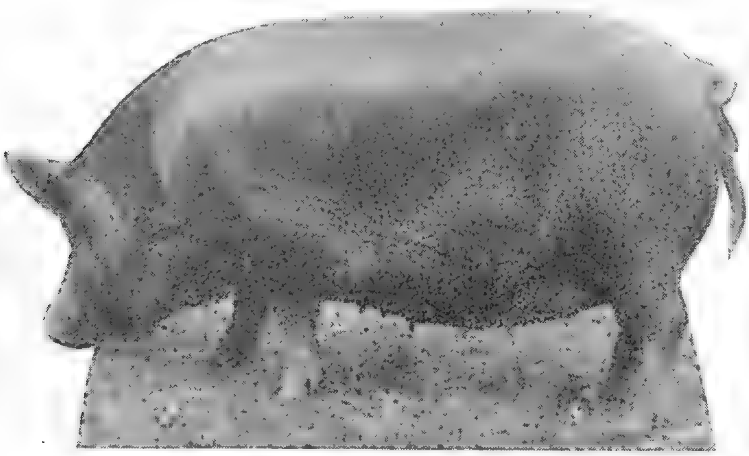


PLATE 243.

To be able to suckle and rear large litters of thrifty pigs is the brood sow's task in life. Such a sow as this has the capacity—she is "Glenburra Molly," from the stud of H. J. Keevers, a noted Richmond River breeder, New South Wales.

There is no doubt, also, that the Tamworth as one of England's oldest pure breeds, has justified its distinction as a breed eminently suitable for crossing where the object is to secure more quality, greater length of side, fine bone and higher percentage of lean meat. As stated, the Tamworth is descended from the old English forest pig without admixture of foreign blood; it therefore preserves the characteristic for leanness which has all along been a cardinal point in its favour. Wherever bacon pig classes (and in many instances pork pig classes also) and carcass competitions have been held, the Tamworth is represented by one cross or another. It has been truly said that there is no more popular cross than the Tamworth-Berkshire for production of bacon and pork in Australia, and in many other parts of the world.

The Tamworth possesses a naturally robust constitution, giving it an advantage in a country like Australia, especially under open air conditions and paddock feeding; for being by nature a grazing animal accustomed to live in the open, he is at his best when kept out of doors. The fact is that the Tamworth is not a good sty pig, his nature rebels

against sty-fed conditions; and he is less resistant to disease than when kept out of doors.

Tamworths Suit the Bacon Curer.

It has recently been computed by a number of leading bacon curers that a long, level-sided pig with fine shoulders, small jowl and back of moderate width, will produce as much as ten per cent. less of fat, and an accordingly increased ratio of lean meat. When it is borne in mind that fat is only worth half as much as lean, it will be appreciated readily how the Tamworth excels as a commercial proposition.

Consistent Prolificacy.

Tamworths are good farm pigs, hardy and prolific breeders, often producing 12 or 14 pigs at a litter (although 8 or 9 is closer to their average). The sows are good sucklers and docile with their young; if they are not, they should be immediately culled and be replaced by better sows.

PLATE 244.

"Glenburra Gem," a long-bodied Tamworth sow, with good middle piece, excellent hams, and a light forequarter such as is the objective in selection of breeding stock. She is a product of the Glenburra Stud, and was a prominent prize-winner at Royal National Show, Brisbane.

That Tamworths are long-lived as well as prolific has been proved by an old supporter of the breed in Staffordshire, who until recently had a sow that actually reared 168 pigs from 12 litters—an average of 14. The sow herself realised £17 after weaning her last litter. This is a record in prolificacy not often beaten by sows of the larger breeds.

While it is admitted there are breeds that produce more pigs per litter, the capacity to suckle and rear the progeny is an even more important factor and, generally, the Tamworth can be regarded as a reliable mother. To those who cannot afford to keep pure bred sows, the first cross sow, i.e., first cross between the Tamworth and Berkshire makes an ideal farmer's breeding sow, often superior in capacity to rear large litters to the pure bred.

For Crossing.

For crossing with other breeds the Tamworth can be strongly recommended, this, no doubt, being attributable to the fact that it is the oldest pure breed in England. Its type is, therefore, quite distinct and its prepotency unequalled. Owing to the length and depth of its sides and other characteristics of the baconer, the Tamworth is unexcelled for improving the flesh, fining the shoulders and reducing the jowls of many other breeds. The curer is always seeking to secure greater length of side and less fat in the pigs for his trade. The Tamworth is just the breed to cross with types that are shorter and deeper in body and with more plump compact hams. It is for this reason that the Tamworth has proved so popular as a cross with Berkshires and Middle Whites, which are more compact in body, carry a greater proportion of fat and have well developed hams. Crosses with types like the Large

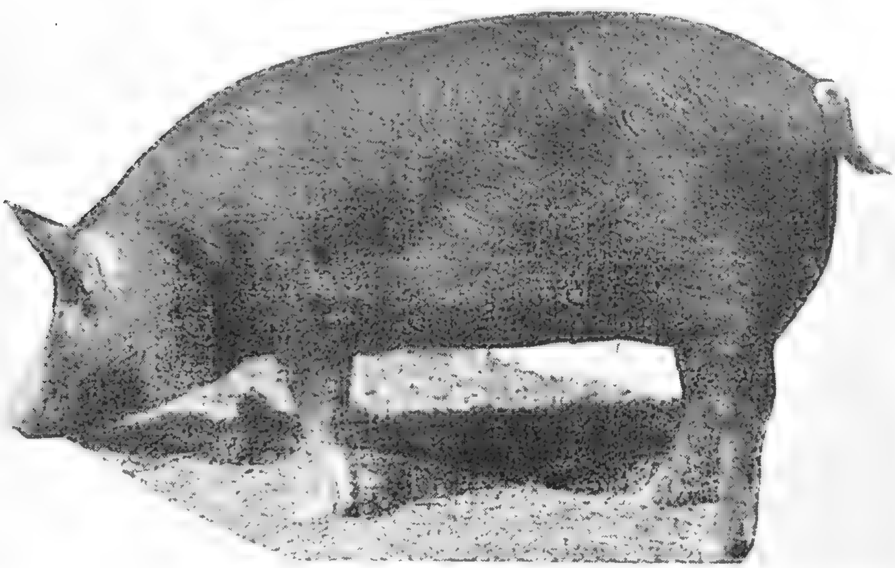


PLATE 245.

"Traveston Viola." Tamworth sow, bred by Mrs. A. Alford, of Traveston, owned and exhibited by G. W. Winch, Zillmere. A really good sow, that has since reared good litters, the photograph being taken when she was quite young after winning first prize at the Royal National Exhibition, Brisbane.

White are not recommended, for reason that both these breeds belong to the large framed class, and if crossed are productive of a type that is too tall and leggy and with insufficient substance, especially for the lighter weight class of pig required for Australian trade; such a cross would be ideal for a bacon pig weighing up to 200 lb. dressed weight—far above the maximum desired in this country. Similarly, it is unwise to expect ideal porkers or baconers when Tamworths are crossed with large type cross-bred sows. The type represented by the Tamworth-Berkshire first cross permits of the progeny being prepared either for the porker or baconer trade, with a decided preference for medium weight pigs in either class.

Colour of the Tamworth.

In a review of the breed in the Jubilee issue (1934-35) of the Pig Breeders' Annual, Mr. J. A. Frost quotes many interesting references to the capacity of the Tamworth to adapt itself to ordinary farm conditions. He states it is the only red-haired breed of pig in Britain, and in that sense is regarded as not only hardy but persistent. The original golden or chestnut colour is said to have been fixed by the foundation sire, a jungle pig imported from India by Sir Francis Lawley, of Middleton Hall, Tamworth, England, about 1800. The Middleton herd played a very prominent part in the breed's early history. After being used on different farms this original jungle pig seems to have had a long and strenuous life and to have stamped his offspring with his own red colour, thereby fixing a distinctive characteristic of a breed which

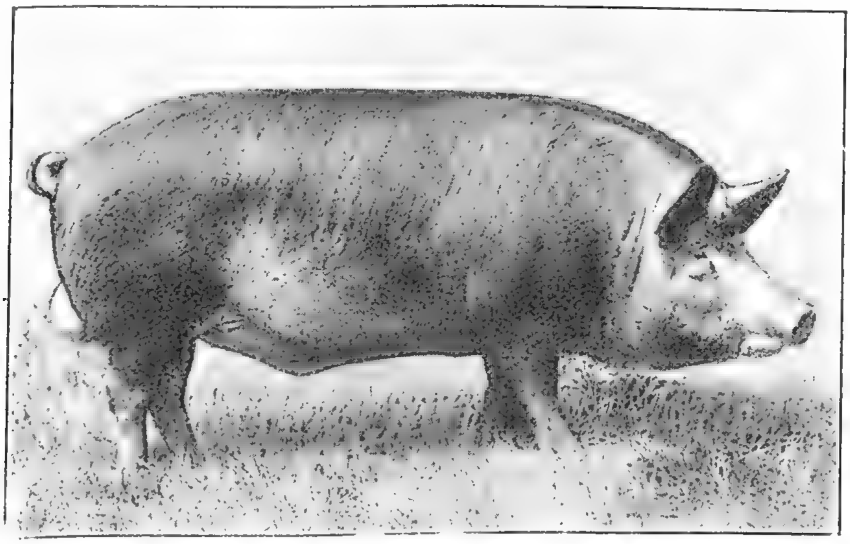


PLATE 246.

Tamworth Boar of the most approved type. "Berkswell Up-to-date," bred and exhibited by Colonel C. J. H. Wheatley, Berkswell, Warwickshire, England. Illustrated in "Pig Breeders' Annual," published by National Pig Breeders' Association, London.

was to become famous throughout the world. So famous, in fact, that on the dispersal of Robert Ibbotson's herd in 1924, his champion sow "Knowle Favourite" realised the record price of 200 guineas, the buyer being Major J. A. Morrison, a prominent herd master whose pigs have had a wide distribution. The same purchaser paid 150 guineas to secure a boar, "Knowle Newcastle," a noted prize-winner. At Mr. Ibbotson's sale the average for 24 sows and in-pig gilts was £47 3s. 9d.; the general average, including small pigs, being £30 6s. Another celebrated herd was that owned by Mr. Egbert de Hamel, Middleton Hall, Tamworth; Mr. C. L. Coxon secured his earliest stud animals from this herd. Theo. A. Stephens, who edited "Farming" for a number of years and later published the popular "Pigs Journal," was well known to numerous Australians. Mr. H. C. Stephens, of Cholderton Lodge, referred to earlier in this report, was also a very successful breeder.

At present, the largest and by far the most important Tamworth herd in England is owned by Colonel C. J. H. Wheatley, at Berkswell Hall, Coventry, from whose stud the parents of the champion sow at

Brisbane Exhibition, 1934, was imported by Mr. Bartram, of Victoria. Colonel Wheatley has a model piggery, a grand collection of sows and boars, and has been a very prominent prize-winner and importer at all British shows. There is a host of other breeders in England, but, strangely enough, the Tamworth has lost ground in recent years and is to-day not by any means a popular breed there, if one may judge by the very limited number of animals registered each year in the British Isles. In fact, more Tamworths are now registered in Australia every year than in Great Britain. This very fact should give breeders of Tamworths in Australia an excellent opportunity, for, with a shortage in England and a world-wide demand, it behoves Australian breeders to advertise extensively and bring before the world the wonderful quality and improved type of Tamworth pigs as bred here. It can justly be claimed that we now have in Australia, and in Queensland in particular, Tamworths equal in quality to the imported stock; thanks to imported parents plus care in breeding, feeding, and handling.

PLATE 247.

Group of prize-winning Tamworth sows, Royal Easter Show, Sydney. Owned and exhibited by Mr. F. S. Ebbern, Kelso, New South Wales.

The Tamworth breed owes much of its success in this country to the New South Wales Department of Agriculture, to the Hawkesbury Agricultural College, and, in more recent years, to the imported animals selected in England by Mr. Andy F. Gray, Senior Piggery Instructor in the New South Wales Agricultural Department, whose constant advocacy of the Tamworth-Berkshire cross has borne good fruit, and has assisted considerably in maintaining for the Tamworth its place among breeds of pigs in Australia.

Queensland breeders of Tamworths represented at the 1934 Royal National Exhibition, include Messrs. Jas. Barkle of the Wattledale Stud, Kingaroy; Bowman & Sons, Kin Kin; P. V. Campbell, Lawn Hill, Lamington; W. S. Hendry, Ascot Vale, Clifton; H. B. Kerner, Warwick Road, Ipswich; E. L. Melville, Caboonbah; M. Moffatt, Billinudgel, New South Wales; H. H. Seliars, Tabooba; Wide Bay Stud Piggery, Gympie; and G. W. Winch, Church Road, Zillmere. Many of the animals trace back to the Traveston Herd owned by Mrs. A. Alford. Mr. Lloyd Skerman, of Waverley, Kaimkillenbun, is another successful junior breeder and exhibitor.

Following is the standard of Excellence adopted by the Australian Stud Pig Breeders' Society:—

STANDARD OF EXCELLENCE FOR TAMWORTHS.

	Points.
Head and Ears.—Head fairly long; snout moderately long and quite straight; face slightly dished, wide between ears; ears rather large, with fine fringe carried rigid and inclined slightly forward	15
Neck and Shoulders.—Fairly long and muscular, especially in boar; chest wide and deep; shoulders fine, slanting, and well set	10
Back and Sides.—Back long and straight, with loin strong and broad; sides deep; ribs well sprung, and extending well up to flank; belly deep, with straight underline; and in sows, twelve good, evenly placed teats ..	20
Hams.—Broad, full, well let down to hocks; tail well set up and well tasselled	20
Legs and Feet.—Legs strong and shapely, with plenty of bone, set well outside the body; pasterns strong and sloping; feet strong and of fair size	15
Colour, Skin, and Hair.—Golden red hair on a flesh-coloured skin, free from black; skin fine and free from wrinkles; hair abundant, long, straight, and fine	10
Character.—A combination of all the points showing distinctive breeding, type, and quality	10
	100

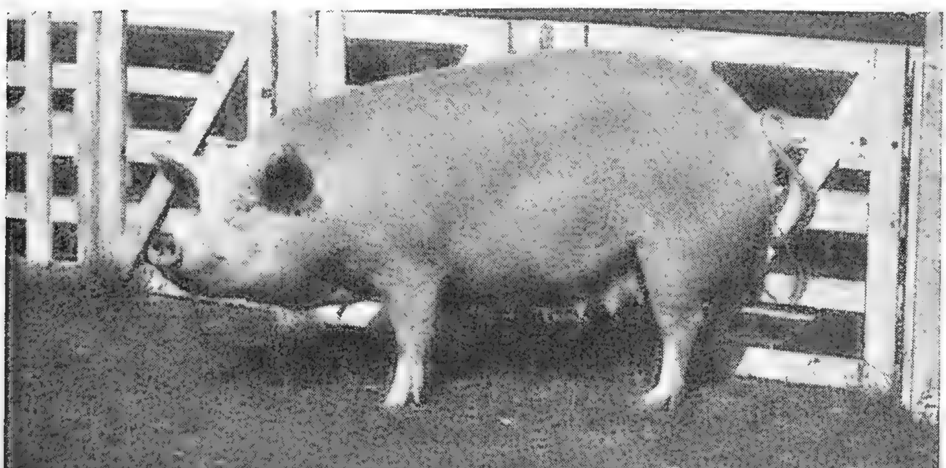


PLATE 248.

RESERVE CHAMPION LARGE WHITE SOW.—"Gatton Vera." Exhibited by Gatton College.

Cucumber Growing

Supplied by the Fruit Branch.

THE warmth of the climate makes this crop a very suitable one for this State. In the coastal and northern districts several crops can be grown during the season.

Planting is usually done in the southern, coastal, and inland districts from September to January, and on the tablelands from October to January; in the northern districts, on the coastal areas from July to January, and on the tableland and inland areas from August to January.

The Agricultural Chemist, in his pamphlet on "Complete Fertilizers," states: Cucumbers may be grown on almost any soil so long as it is fairly light and loamy and plenty of manure is added. The pits or hills should be prepared by mixing a large amount of well-rotted stable manure, sheep or fowl dung, ashes, and bonedust with the soil. Apply in addition the following artificial fertilizer:—

1½ cwt. sulphate of ammonia or nitrate of soda;

3 to 4 cwt. Nauru phosphate—superphosphate mixture;

1 to 1½ cwt. sulphate of potash;

or 6 to 8 cwt. of a 5-12-5 mixed fertilizer per acre, or 2 to 3 oz. of the same mixture per square yard.

The terms "pits" or "hills" are used to represent groups of four or five plants. At one time the seed was always sown on hills raised above the ground level, but unless the ground is badly drained this practice need not be followed.

Four or five plants are sufficient to a "hill," and the seeds should be placed 3 or 4 inches apart and about 1 inch below the surface. The "hills" should be about 4 feet apart each way, and the whole surface left loosely cultivated.

Should the plants send out their runners to a distance of 2 or 3 feet without setting cucumbers, fruiting may often be induced by pinching out the tips of the runners.

Cucumbers should be harvested when nearly full grown, before the seeds harden and the skin begins to turn yellow.

The time from planting to harvesting is usually about three months, and 1 lb. of seed set out as directed will plant an acre.

The varieties recommended are: For market purposes, Imperial White Spine; for pickling, Early Green Cluster.

Standardised Judging of Fruit.

By JAS. H. GREGORY, Instructor in Fruit Packing.

THE aim of all fruit exhibitions should be the improvement and advancement of the fruit industry. The achievement of this can be advanced by close attention to the production of better-quality fruit and the use of better marketing methods. The exhibition of fruit at shows is of appreciable assistance in permitting comparisons to be made of different growing methods, and their ultimate result in quality and colour. The progress of various packing methods may also be examined per medium of the show bench.

To obtain the most helpful results from the fruit displayed, only one system of comparison for judging can be used—namely, the points system of making awards. The use of this system places the judge in the position of helping the exhibitor, the particular advantages of any exhibit being definitely compared. Judges using a comparison not embracing a definite points system lose this advantage to the exhibitor, often resulting in dissatisfaction. The allotment of points can be left to the judge, a variation of the number allowed to each section being made at the discretion of the judge according to the particular section of the exhibition.

The following tables of points are suggested as a good basis to work on. This table may be varied to suit the various classes of exhibits, a basis of 100 points being allotted to each exhibit. As an example, where fruit is displayed in a section for fruit only, the whole 100 points would be allotted for the fruit; but where it is a case or tray section the 100 points would be split into two sections, 60 points for the fruit and 40 points for packing, &c., totalling 100 points. An examination of tables given for "Fruit Packing Classes" and for "Specified Classes" will serve as a basis of comparison:—

POINTS GIVEN WHEN JUDGING FRUIT PACKING CLASSES.

	Points.
Fruit—	
Type	15
Colour	10
Freedom from Imperfections	15
Quality	10
Maturity	10
Packing—	
Alignment	10
Height	10
Sizing	10
Compactness	10
Total	100

POINTS GIVEN WHEN JUDGING SPECIFIED CLASSES, SUCH AS FOR EXPORT, COOKING, OR DESSERT:

	Points.
Fruit—	
Commercial Value	5
Suitability	5
Type	5
Colour	10
Freedom from Disease, Imperfections, &c.	15
Quality	10
Maturity	10
Packing—	
Height	10
Alignment	5
Sizing	5
Compactness	10
Wrapping	5
Get-up	5
Total	100

These tables may be adapted to all fruit. An explanation of the various headings used should be of assistance:—

Type: Shape; natural size for the variety; with citrus absence of pips according to variety, size of navel if any, texture of skin.

Colour: Colour of fruit at maturity.

Quality: With citrus, thickness of rind, amount of rag inside, juice content, coarseness of cells; other fruits, texture of flesh, juice content, colour of flesh, and flavour.

Maturity: Size and colour of pips; colour of skin and flesh; flavour; acid content in citrus.

Freedom from Imperfections: Freedom from skin blemishes, spray damage, and disease or insect infestation.

Commercial Value: Suitability of the variety commercially for the particular class of entry; i.e., export class, variety Granny Smith apples would have a higher commercial export value than Pomme de Neige or Farmuese.

Suitability: Export classes, this would embrace size, variety, and ripeness.

LIME WATER FOR CALVES.

Besides being a necessary mineral constituent for all classes of animals, lime acts also in correcting acidity in the stomach. It also renders the curd portion of milk more readily digestible, particularly by young calves.

Lime-water of the requisite strength is easily made on the farm. There need be no fear of making it too strong, as water will only dissolve a certain limited amount of lime—½ grain to the ounce, or 10 grains to the pint. Add a bucketful (say, 20 lb.) of lime to about 10 gallons of water in a wooden barrel, stir well, and allow to settle. The clear liquid resulting can be used, and water added and stirred daily until all the soluble portion of the lime has dissolved—the lack of alkaline flavour will indicate when this point has been reached, and a fresh supply of lime should be added to the barrel.

Marketing Notes.

By JAS. H. GREGORY, Instructor in Fruit Packing.

Tomatoes.

INSPECTIONS in the Brisbane markets reveal that growers have not profited by marketing results of past seasons in respect of green tomatoes. Many consignments of tomatoes have cases containing from green to ripe fruit; from the marketing point of view this is unsatisfactory to buyers. Growers would find that an effort at colour grading, in conjunction with good packing, would be well repaid. Close attention should also be paid to interstate consignments, care being taken to eliminate all immature fruit. Immature fruit early in the season has a depressing effect upon the market from which it takes a lot to make it recover.

Papaws.

During the winter papaws have been sent successfully to the Southern markets in a more advanced stage of ripeness (i.e., firm coloured) than in previous years. While this practice is correct for the cooler months, care must be taken now that the hot weather is approaching to select fruit in a less advanced state of maturity. This applies particularly to Melbourne consignments, which have a much further and hotter journey than Sydney consignments.

Citrus.

The Queensland citrus season is now drawing to a close, but marketing conditions remain the same. Regularity of consignments is the only method of obtaining the best from the present unsatisfactory state of the market. Small fruit should, as far as possible, be kept off the market. Growers, by rotating their picking and carefully selecting the largest fruit at each picking, will considerably increase their yield and quality, thereby enhancing the tone of the market and getting better prices.

Stone Fruits.

Now that the stone-fruit season is upon us growers should become acquainted with the marketing regulations. Grade standards for the stone fruits must be carefully adhered to. Close attention to packing-shed cleanliness should be observed if the dreaded brown rot is to be kept within bounds. All reject fruit should be carefully destroyed and not left in cases or picking boxes in the shed. This will also help in keeping fruit-fly within bounds. Growers will find that close attention to sizing all fruits will be amply repaid.

CARE OF THE SEPARATOR.

The operation of the separator and the care devoted to its cleansing have a material effect on the quality of cream produced. On no account should the separator be left overnight without being dismantled, and all parts thoroughly cleansed and scalded. After separating, all utensils and separator parts with which milk has come in contact, including the vats, buckets, and strainer, should be washed with slightly warmed water and then submerged in boiling water and placed on racks to drain. The practice of wiping over the utensils with a cloth after scalding only serves to undo the work of sterilisation and to reinfect with bacterial organisms.

Milk should not be left lying about on the floor or under the separator block, and the surroundings should be kept sweet and clean, and the drains free to carry away the floor washings.

By H. W. BALL, Assistant Experimentalist.

THE rainfall for the months of August and September was generally under average throughout Queensland, so that seasonal crops were affected and natural feed reserves were becoming depleted by the time the welcome change occurred during the second week of October. The recent excellent rains throughout the farming areas will expedite the sowing of cotton, maize, tobacco, peanuts, and summer fodder crops.

Wheat.

Harvesting is now in full swing, and, providing no damaging storms or heavy rains are experienced during this important period, an average crop of good quality wheat should be garnered. Prospects appear particularly good in the Pittsworth district, where farmers benefited by conserving much of the heavy rain of the previous summer. It is the late-sown areas that will give the lightest return, indicating that the importance of thorough cultivation during a reasonably long fallow period cannot be too strongly emphasised. Excellent crops are also reported from the Dalby district, notably on the Jimbour plain.

Considerable expansion of the wheat and dairying industries is taking place in the Dalby area on lands previously devoted to sheep-raising.

In the Clifton, Allora, and Warwick districts the returns will be under average, partly because of lands being withheld from cultivation owing to the wild oat pest. These areas have been cropped to wheat for over fifty years, and the need for a long fallow period, to assist in reducing weed pests, is now apparent. Very little wheat will be harvested in the Maranoa this year, owing to the dry conditions experienced, and also to an attack by grasshoppers shortly after the plants appeared above ground. Isolated farms will yield good crops, notably in the Wallumbilla area, where the sandy loam soils favour the retention of moisture, so important in a comparatively dry area. Wheat is a precarious crop, and the grower knows from experience that he is never sure of his return until the grain is in the bag, so that a yield forecast can only be approximate.

PLATE 249.—A FINE PADDOCK OF PUSA WHEAT NEAR YANGAN.
" . . . a-keepin' of my feet,
While I cater for the nation with my wheat, wheat, wheat."

Tobacco.

Considerable attention will again be devoted to tobacco experimental work, the season's programme including variety, rotational, fertilizer, and green manurial trials, together with seed propagation plots in selected pure-seed areas. The planting of seed beds will now be proceeding, and growers are strongly advised to spray in accordance with departmental recommendations. Blue mould and leaf miner have been reported from seed beds sown during August and early October, where such spraying was not carried out. Such beds are a menace to those

PLATE 250.—ANOTHER FINE STAND OF PUSA NEAR WESTBROOK.
"Of the world's great work he has done his share who has garnered a crop of wheat."

established later on, and point to the need for a definite break of at least three months from the time the residue of one crop is destroyed, until the seed of the succeeding crop is sown.

PLATE 251.—A FIELD OF CLARENDON WHEAT NEAR TANNYMOREL.
"Sowin' things an' growin' things, an' watchin' of 'em grow."

Sugar.

Increasing temperatures have accelerated the growth of cane in the far North, and welcome falls of rain of upwards of 2 inches were recorded in the Mackay and Bundaberg districts in the latter half of the

PLATE 252.—ANOTHER GOOD CROP OF CLARENDON NEAR WESTBROOK.
" . . . From God's earth His gift of wheat."

month. This has considerably improved the outlook, although subsequent drying winds have nullified the benefits to some extent in the Bundaberg district.

PLATE 253.—ANOTHER FINE STAND OF CLARENDON ON CANNING DOWNS.

"Oh, I am the grass that has conquered man,
I am the King that is Bread!
Your armies and fleets are but fragile things
That await a nod of my head."

Crushing has been completed at Babinda and Mossman, where tonnages greatly below those of last year were crushed. Crops continue to cut above estimates in the Central and Southern districts, but owing

PLATE 254.—A FAMILIAR SIGHT ON THE DARLING DOWNS DURING THE WHEAT HARVEST.

"Then I come up bright an' grinnin' with the knowledge that I'm winnin'
With the rhythm of my harvester an' wheat, wheat, wheat."

to the lower tonnages in the North it is anticipated that the amount of sugar in No. 1 Pool will be somewhat less than was the case last year.

Flax.

Assistance has been granted through the Rural Assistance Board to a Flax and Linseed Company operating in Queensland. A large home market awaits the linseed grower, but hitherto there has been no demand for the flax fibre owing to the lack of manufacturing interest. Experience with this crop in Queensland is too limited to state definitely its possibilities, but the wise policy of encouraging the development of any promising sideline is being pursued.

General.

Large areas are being sown to maize, sorghums, sudan grass, and millets for fodder purposes. The preparation of land was held up considerably by the previous dry spell, but farmers are now losing no time in taking advantage of the altered conditions. Early potatoes have brought very remunerative prices, up to £20 per ton having been received. Reports indicate that the canary seed crop will be below average, owing to considerable areas being utilised for fodder purposes.

Plate 255.—A Cabbage from St. Lucia.

At St. Lucia Farm School vegetable gardening is an important part of the curriculum. This specimen was one of a large number of heavyweights. It tipped the beam at 18 lb.

Brisbane Show Champions, 1934.

PLATE 256.
Champion Polled Hereford Cow, "Lovely II." (S. A. Plant).

PLATE 257.
Champion Friesian Bull, "Tent Hill Starlight Actuary" (W. H. Grams).

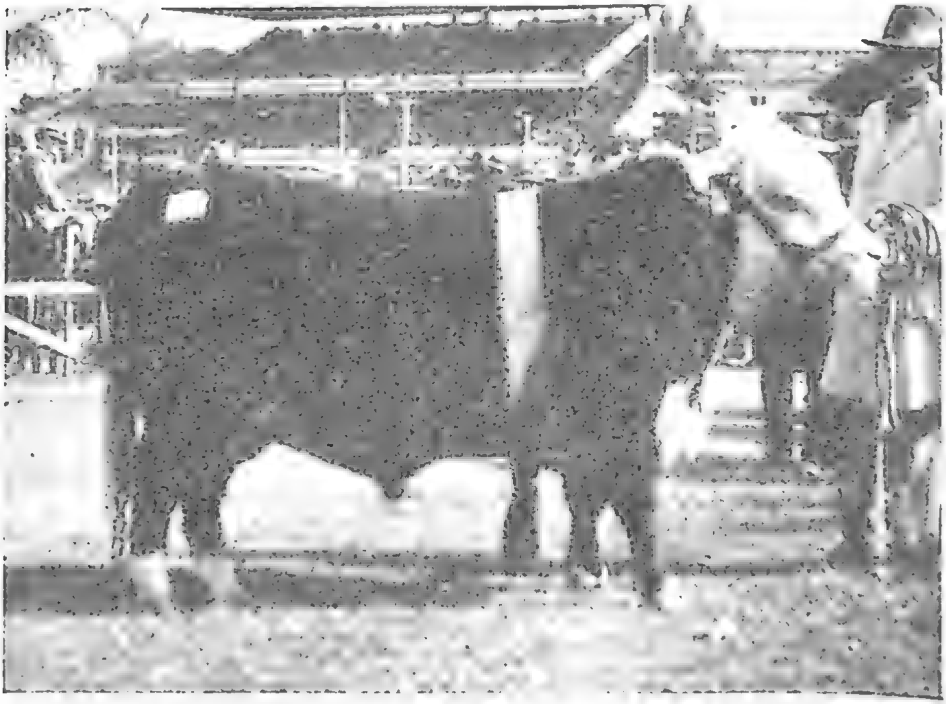


PLATE 258.
Champion Hereford Bull, "Mc Mel Chieftain" (C. S. Rowntree).

PLATE 259.
Champion Guernsey Cow, "Carramana Dolly" (A. E. Gillespie).

PLATE 260.
Champion Jersey Bull, "Trinity Darby" (W. W. Mallett).

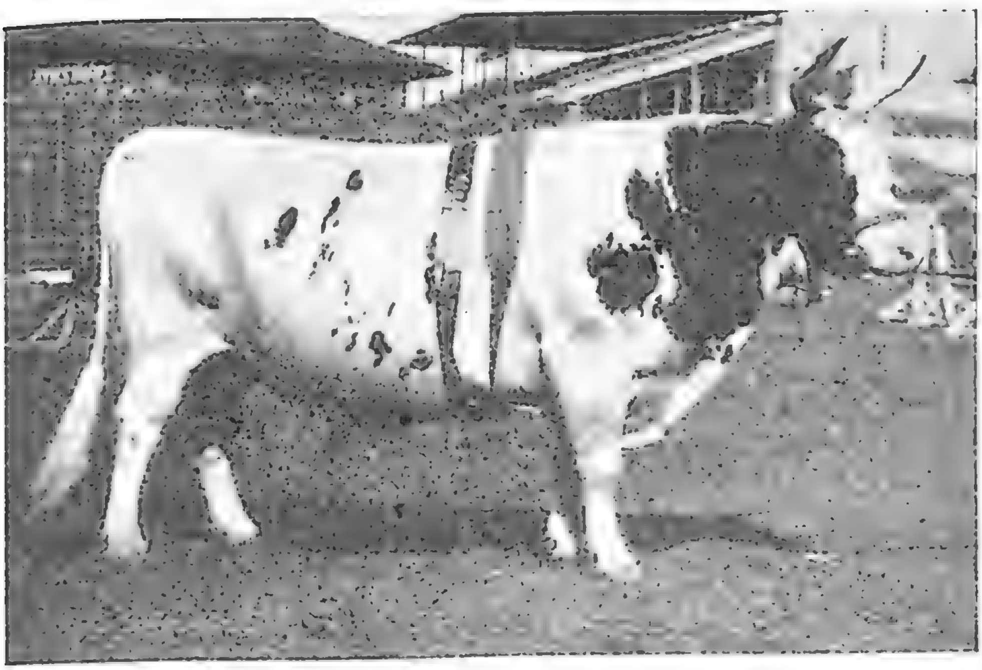


PLATE 261.
Champion Ayrshire Bull, "Longlands Bosca" (T. E. Holmes).

PLATE 262.
Champion Polled Hereford Bull, "Trevanna King" (S. A. Plant).

PLATE 263.
Champion A.I.S. Bull, "Patrol of Cosy Camp" (Paul Moore).

PLATE 264.
Champion Guernsey Bull at the Brisbane Show, "Spurfield Rocket," owned by A. E. Gillespie, Tanto, Springbrook.

PLATE 265.
Champion Beef Shorthorn Cow at the Brisbane Show, "Netherby Snow Queen," owned by J. T. Scrymgeour, of Netherby, near Warwick.

PLATE 266.
Champion Hereford Heifer at the Brisbane Show, "Ennisview Cherry Ripe IV."
(E. R. Reynolds).

PLATE 267.
Champion A.A. Cow at the Brisbane Show, "Bald Blair Twinkle IV."
(F. J. White and Son).

PLATE 268.
Champion Shorthorn Bull, "Netherby Royal Challenge" (J. T. Scrymgeour).

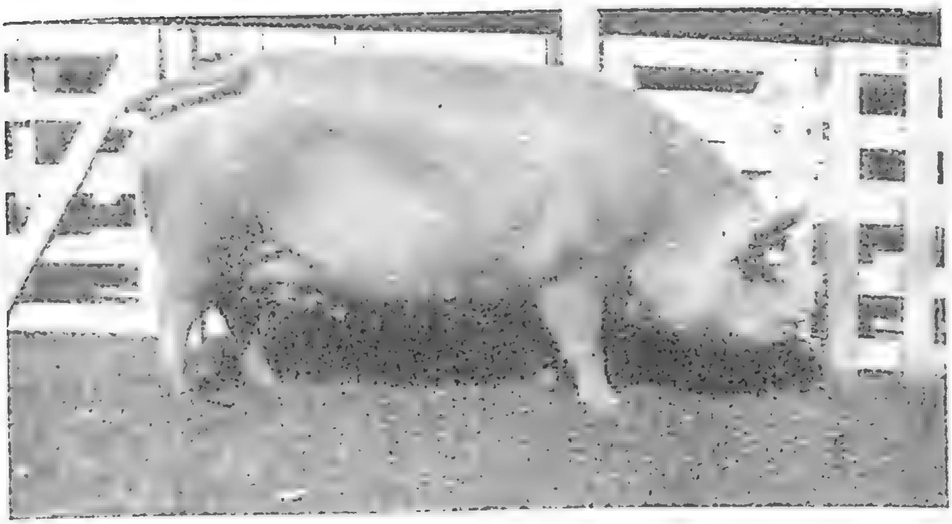


PLATE 269.
CHAMPION LARGE WHITE SOW.—"Pine Terrace Pear" (imp.). Exhibited by J. A. Heading, Murgon.

PLATE 270.

CHAMPION LARGE WHITE BOAR.—"Norfolk King David 5th." Exhibited by the Queensland Agricultural College and High School.

PLATE 271.

CHAMPION MIDDLE WHITE SOW.—"Norfolk Poppy 3rd." Exhibited by J. J. Slack, Dinmore.

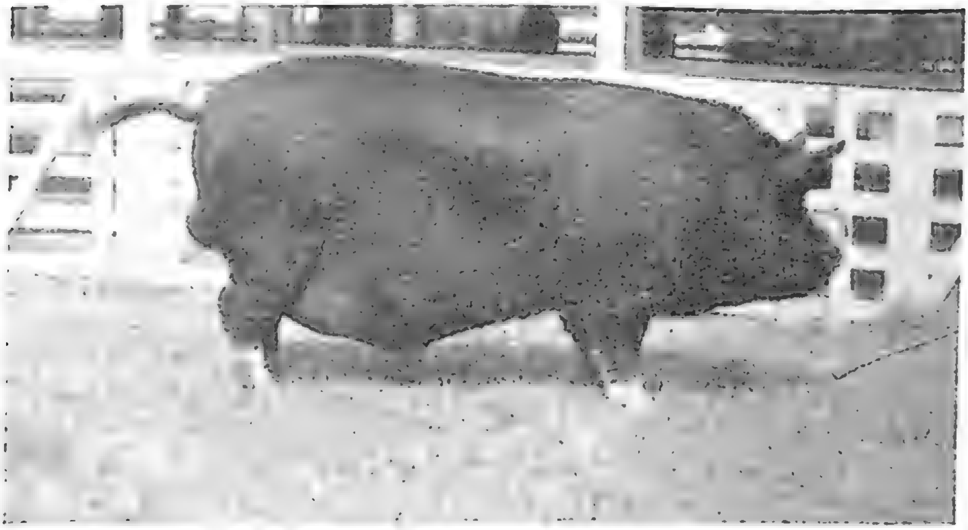


PLATE 272.

"Grafton Trump," who carries English blood, has proved himself an excellent stock getter and prize winner; among his winnings is the boar and progeny prize at the Brisbane Exhibition, 1934. Exhibited by Messrs. Mat. Porter and Sons, Wondai.

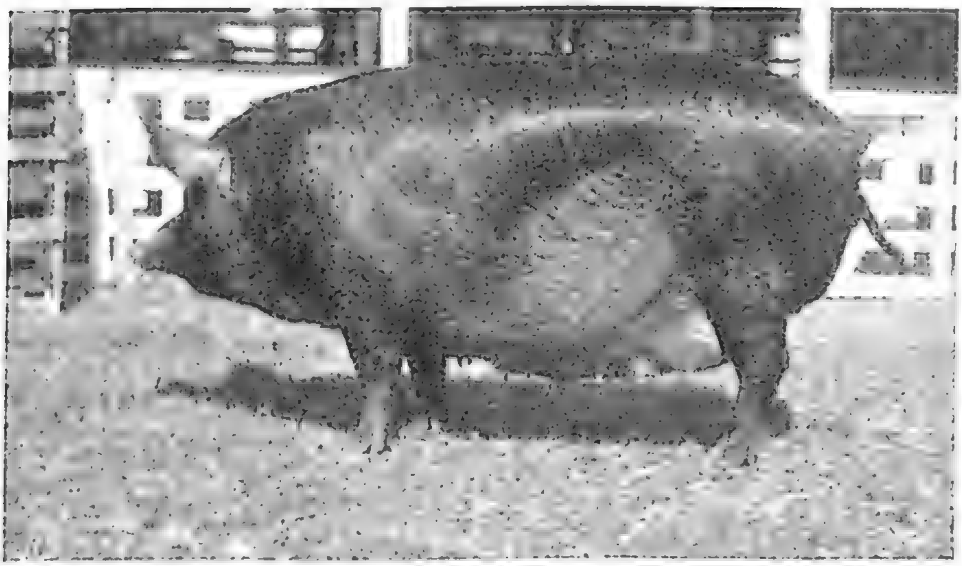


PLATE 273.

CHAMPION TAMWORTH SOW.—"Warringal Precocious," imp. in dam. Exhibited by J. Barkle and Son, Kingaroy, at the Brisbane Show.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, the Red Poll Cattle Society, and the Friesian Cattle Club, production charts for which were compiled for the month of August, 1934 (273 days period unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORN.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Gem IV. of Oakvilla	H. Marquardt, Wondai	11,293·62	456·677	Victory of Greyleigh
Pansy 4th of Oakvilla	H. Marquardt, Wondai	11,716·91	444·99	Victorious of Oakvilla
Princess II. of Headlands	J. A. Heading, Cloyna	13,215·69	424·681	Major of Rosemount
Ashdale Red Duchess	A. Frank, Boonah	9,363·9	423·176	First Warrior of the Cedars
Molly of Mount View	V. Dunstan, Wolvi	9,551·65	382·498	Charming Lad of Hillview
Darling of Salt Bush Park	R. Ray, Yargullen	9,684·0	359·727	Hero of Strathdu
SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.				
Duchess of Kalinga	J. A Heading, Cloyna	10,480·71	418·915	Duchess Jellicoe of Fairfield
SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.				
Green Ridge Primrose 7th	E. W. Lawley, Maleny	8,601·7	338·435	Perfection of Arley
JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.				
Morden Sparkle (365 days)	R. Mears, Toogoolawah	16,239·8	659·276	George of Nestles
Springleigh Tulip (258 days)	Moller Brothers, Boonah	8,207·05	329·643	Red Knight of the Cedars
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.				
Blacklands Red Plum 6th	M. C. and A. M. Sullivan, Pittsworth	9,928·47	324·47	Hugo of Blacklands
Kilbirnie Bella 17th	Macfarlane Bros., Radford	7,476·15	309·316	Kilbirnie Guardsman
Jess IV. of Blacklands (258 days)	A. M. Johnson, Gracemere	7,677·2	309·107	Hugo of Blacklands
Beaudetta 3rd of Springleigh	Moller Bros., Boonah	8,217·6	300·220	Red Knight of the Cedars
College Ettie 3rd	Queensland Agricultural High School and College, Gatton	6,930·85	299·446	Fussy's Kitchener of Hillview

Senior 2 Years (over 2½ Years), Standard 250 Lb.—*continued*.				
Rosalind II. of Headlands	J. A. Heading, Cloyna	6,959·59	278·806	Headlands Red Plum
Lucy VII. of Blacklands (257 days)	A. M. Johnson, Gracemere	6,141·45	270·206	Orama of Blacklands
Blacklands Fancy 5th	M. C. and A. M. Sullivan, Pittsworth	7,768·55	268·792	Major of Blacklands
Junior, 2 Years (under 2½ Years), Standard 230 Lb.				
Claredale Dainty	J. E. Smith, Brookstead	8,610·7	358·954	Wilga Vale Masterpiece
College Queenie 2nd	Queensland Agricultural High School and College, Gatton	7,779·2	322·707	Duplex of Greyleigh
Heather of Glengarry	Geo. Waugh, Peeramon	7,227·3	312·605	Jean 7th Prince of Blacklands
Highfield Pink II.	J. A. Heading, Cloyna	8,502·94	306·639	Banker II. of Greenslopes
College Beryl	Queensland Agricultural High School and College, Gatton	6,829·03	286·127	Fussy's Kitchener of Hillview
Mabreen Rosebud	V. Dunstan, Wolvi	7,063·3	285·781	Numbawarra Headlight
Brundah Elfin II.	Mrs. K. Henry, Greenmount	7,417·71	277·959	Enchanter of Carawarra
Rosemount Melba 12th	P. D. Feichtner, junr., Hirstvale Road	7,174·36	272·553	Bright Star of Cosey Camp
Highfield Princess II.	J. A. Heading, Murgon	6,922·82	269·492	Gloaming of Hill Top
Kingsdale Dulcie 14th	A. A. King, Mooloolah	6,214·15	264·85	Express of Burradale
Sadie of Glengarry	Geo. Waugh, Peeramon	6,125·05	258·223	Jean 7th Prince of Blacklands
Lavender 18th of Quarnlea	Lehfeldt Bros., Kalapa	6,478·37	247·571	Colonel of Quarnlea
College Rachel	Queensland Agricultural High School and College, Gatton	6,434·36	240·042	Duplex of Greyleigh
Brundah Fidget III.	Mrs. K. Henry, Greenmount	6,465·28	232·046	Enchanter of Carawarra

JERSEY.

Mature Cow (over 5 Years), Standard 350 Lb.				
Oxford Favourite Queen	E. Burton and Sons, Wanora	5,785·92	377·648	Oxford Renown
Glengarry Tirania 4th	J. and R. Williams, Crawford	7,428·7	392·729	Glengarry Benedictines Heir
Senior, 4 Years (over 4½ Years), Standard 330 Lb.				
Langside Quip	G. W. Young, Inverlaw	6,577·75	396·701	Masterpiece Yeribee of Brucevale
Senior, 3 Years (over 3½ Years), Standard 290 Lb.				
Lavender of Calton (365 days)	E. Burton and Sons, Wanora	15,248·97	773·424	Prince Clair of Calton
Golden Lassie of Inverlaw	R. J. Crawford, Inverlaw	6,455·35	351·616	Langside Claribella Masterpiece

Production Recording—*continued.*

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	JERSEY—*continued.*			
	JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.			
Langside June Twylish	G. W. Young, Inverlaw	6,497·0	322·53	Masterpiece Yeribee of Brucevale
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Wyreene Pet	J. B. Keys, Gowrie Little Plains	5,343·6	261·281	Goldfinder's Prospector of Morago
College Silva	Queensland Agricultural High School and College, Gatton	5,619·21	332·295	College Silverside
Langside Prim	G. W. Young, Inverlaw	6,158·85	317·154	Masterpiece Yeribee of Brucevale
Glenview Mabel	F. P. Fowler and Sons, Coalstoun Lakes	4,550·85	271·897	Trinity Officer
College Pearl	Queensland Agricultural High School and College, Gatton	4,929·71	270·552	Burnside Defender
College Pixie	Queensland Agricultural High School and College, Gatton	5,043·6	265·563	Burnside Renown
Xenias Charm of Inverlaw	R. J. Crawford, Inverlaw	4,863·6	237·977	Montrose Gypsy of Glen Iris
	RED POLL.			
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Marshlands Prudent Farmer 2nd	C. E. McConnell, Marshlands	7,357·85	279·666	Silver Spring Bulwark
	FRIESIAN.			
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Oaklands Beauty Rock 5th	W. Richters, Tingoora	8,595·45	328·928	Pied Rock
Oaklands Fanny Rock 2nd	W. Richters, Tingoora	7,921·34	305·254	Pied Rock
Oaklands Winara Rock 3rd	W. Richters, Tingoora	7,906·63	287·559	Pied Rock
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
Oaklands Holly Pearl 8th	W. Richters, Tingoora	7,409·03	273·414	Pied Rock

PLATE 274.—THE VALLEY OF THE TWEED.
From Queensland's Southern Border.

Photo.: "Courier Mail."]

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, the Friesian Cattle Club, and the Red Poll Cattle Society, production charts for which were compiled for the month of September, 1934 (273 days period unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORN.			
	MATURE COW (OVER 5 YEARS), STANDARD 350 LB.			
Penrhos Pansy	A. Sandiland, junr., Wildash	13,066·5	569·177	Strathdhu Admiration II.
Elsie of Blacklands	H. D. Giles, Biggenden	10,761·9	496·870	Jeans Monarch of Blacklands
Dinky of Bellwood	S. J. Currant, Gunalda	8,513·5	398·582	Triumph of Oakvale
Amy of Glenleigh	C. O'Sullivan, Greenmount	9,710·7	396·040	Brightlight of Darbalara
Necklace of Hilltop	J. A. Heading, Murgon	9,340·09	365·807	Major of Rosemount
	SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.			
Rocklyn Baroness	T. Strain, Wondai	10,614·31	374·295	King of Sunnyside
Glenroy Pearl	W. F. Kajewski, Glencoe	8,681·23	358·704	Brilliant 2nd of Oakvale
Merridale Lady Gentle	H. D. Giles, Biggenden	8,017·7	348·736	Reflection of Blacklands
	JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.			
Rocklyn Heather	T. Strain, Wondai	8,359·56	368·742	King of Sunnyside
	SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.			
Burradale Daisy 15th	W. F. Kajewski, Glencoe	8,046·74	356·339	Lovely's Earl of Glenthorn
Dnalwon Cherry 2nd	B. J. Nothling, Witta, Maleny	8,379·2	336·628	Limelight of Raleigh
	JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.			
Navillus Amy 2nd	C. O'Sullivan, Greenmount	9,326·75	401·97	Midget's Sheik of Westbrook
Navillus Princess	C. O'Sullivan, Greenmount	9,584·61	374·285	Triumph of Comberton Grange
Merridale Laura	H. D. Giles, Biggenden	5,905·9	271·560	Reflection of Blacklands

	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Glenroy Emerald	W. F. Kajewski, Glencoe	9,111·78	351·386	Glenroy Kitchener
Damsel 10th of Glenthern	W. F. Kajewski, Glencoe	7,669·98	325·377	Shamrock's Triumph of Burradale
Honey 8th of Sunnyside	P. Moore, Wooroolin West	7,566·31	298·849	Bruce of Avonel
Mirth 3rd of Blacklands	A. Pickels, Wondai	6,513·15	290·405	Orama of Blacklands
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
College Rascal 2nd	Queensland Agricultural High School and College, Gatton	8,004·55	337·043	Fussy's Kitchener of Hillview
College Stately 2nd	Queensland Agricultural High School and College, Gatton	6,194·42	308·546	Duplex of Greyleigh
Glenroy Chrystal	W. F. Kajewski, Glencoe	7,055·89	283·27	Digger of Burradale
Rosenthal Hope 15th	R. V. Littleton, Crow's Nest	5,935·56	268·518	Rosenthal Handsome Boy
Rosenthal Lilac 3rd	S. Mitchell, Warwick	5,918·25	254·371	Handsome Boy
	JERSEY.			
	SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.			
Billabong Daisy	J. Mollinhauer, Moffattdale	8,129·46	415·068	Premier of Calton
	SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.			
Linda of Calton	F. J. Cox, Imbil	6,495·15	341·453	Prince Clair of Calton
	JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.			
Trecarne Jean	R. A. Slaughter, Clifton	7,683·67	391·671	Mascot of Brassaldale
Langside Hurette Hope	G. W. Young, Inverlaw	5,669·2	323·860	Masterpiece Yeribee of Brucevale
Wyreene Rose Marie	J. B. Keys, Gowrie Little Plains	5,780·01	284·626	Lyndhurst Victor
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
G. N. Loda 2nd	Cox Bros., Maleny	4,794·8	299·719	Retford Royal Atavist
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
Camelon Princess	H. Neil, Brassall	5,169·17	323·695	Carnation Prince's King
College Starbright 3rd	Queensland Agricultural High School and College, Gatton	5,541·83	309·220	Burnside Defender
G. N. Hecla	Cox Bros., Maleny	5,136·15	277·475	Retford Royal Atavist
Twylish Madeira of Pine Ridge	F. J. Cox, Imbil	4,973·35	275·494	Newhills Mascot
Hampstead Gold Star	Cecil Roberts, Harristown	3,893·75	235·281	Kelvinside Favourite's Raleigh
Wyreene Rosella	J. B. Keys, Gowrie Little Plains	4,562·14	233·080	Goldfinder's Prospector of Moray
G. N. Princess	Cox Bros., Maleny	4,132·35	231·707	Retford Royal Atavist

Production Recording—*continued.*

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
FRIESIAN.				
JUNIOR, 3 YEARS (UNDER $3\frac{1}{2}$ YEARS), STANDARD 270 LB.				
Oaklands Winana Rock II.	W. Richters, Tingoora	8,155·05	315·066	Pied Rock
JUNIOR, 2 YEARS (UNDER $2\frac{1}{2}$ YEARS), STANDARD 230 LB.				
Oaklands Rock Maid III.	W. Richters, Tingoora	8,773·38	303·534	Pied Rock
Oaklands Holly Pearl VII.	W. Richters, Tingoora	7,103·44	254·250	Oaklands Pied Rock 3rd
RED POLL.				
JUNIOR, 2 YEARS (UNDER $2\frac{1}{2}$ YEARS), STANDARD 230 LB.				
Marshlands Marruth Farmer	C. E. McConnell, Marshlands	5,176·17	225·237	Marshlands Farnese

Crown Land for Selection.

YAPPOO EXPIRED HOLDING, HUGHENDEN DISTRICT. SHEEP LAND.

PORTION 2, parish of Yappoo, 26,000 acres, situated about 50 miles north from Nelia, on the Saxby River, will be open for Grazing Homestead Selection at the Land Office, Richmond, on Thursday, 13th December.

Term of lease, 28 years; rent, 2d. per acre for the first seven years of the term. Provisional valuation of the existing improvements, £412. These consist of fencing and bore drains. The country consists of open undulating downs, well grassed with Mitchell, Flinders, Blue, barley, and other grasses. Generally well shaded.

The land is good sound sheep country, suitable for wool-growing and lambing purposes.

Watered by drains from two bores on Bunda Bunda Holding and by billabongs along the Saxby River. Supplies are ample for the carrying capacity of the block.

Stocking conditions will apply.

Free lithographs and full particulars obtainable from the Land Agents, Hughenden and Richmond; the Land Settlement Inquiry Office, Brisbane; and the Government Intelligence Bureaux, Sydney and Melbourne.

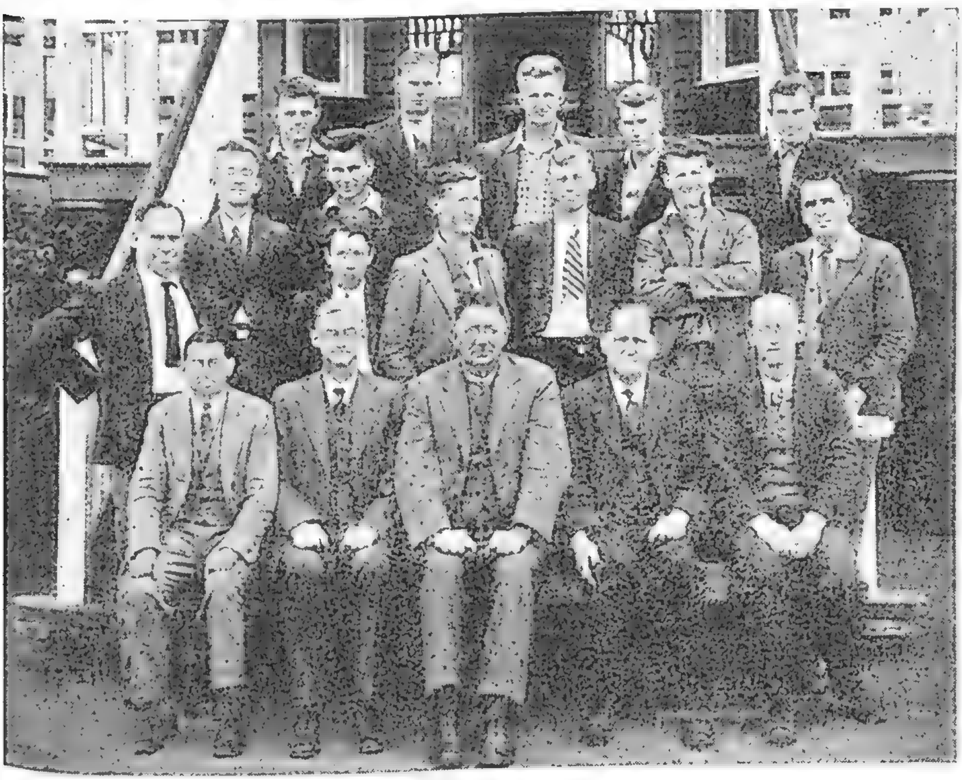


PLATE 275.

Members of the 1934 School of Instruction in Pig-raising at the Queensland Agricultural College, Gatton.

Seated in the centre of the front row is Lt.-Colonel A. J. MacKenzie (Chief of the College Veterinary Staff); on his right is Mr. E. J. Shelton (Senior Instructor in Pig Raising, Department of Agriculture and Stock), and on his left is Mr. C. J. McGrath (Supervisor of Dairying, Department of Agriculture and Stock).

PLATE 276.—JUNIOR MEMBERS OF THE BRISBANE LEGACY CLUB.

(On the occasion of an instructional visit to the Department of Agriculture and Stock, 29th September.)

The Legacy Club is an association of ex-service men who have voluntarily assumed the guardianship of war orphans and the sons and daughters of ex-sailors and soldiers who have died or become permanently incapacitated since the war. In this spirit Legacy carries on, overcoming difficulties as they arise, shunning personal publicity, and proving quietly but splendidly that the spirit of the Australian Imperial Force has survived, and is still an effective force in Australian national life.

Answers to Correspondents.

BOTANY.

Replies selected from the outward mail of the Government Botanist, Mr. Cyril White, F.L.S.

Saltbush and Related Plants. Books on Botany.

H.R.L. (Gympie)—

Regarding the family *Chenopodiaceæ*, the following are some common plants in Queensland:—

Old Man Saltbush (*Atriplex nummularia*).
Saltweed or Creeping Saltbush (*Atriplex semibaccata*).
Blue Bush (*Chenopodium auricomum*).
Fish Weed (*Chenopodium triangulare*).
Cotton Bush (*Kochia villosa*).
Galvanised Burr (*Bassia Birchii*).
Fat Hen (*Chenopodium album*).

Books on Australian botany:—

An Elementary Text-book of Forest Botany, by C. T. White. Price, 7s. 6d.

The Story of Our Plants: First Steps in Australian Botany, by Constance M. le Plastrier. Price, 2s.

Intermediate Botany, by A. B. Katley. Price, 2s.

The last two are published by the Shakespeare Head Press, Sydney, but all three books should be obtainable from any bookseller.

"Vegetable Oyster."

M.R. (Toowoomba)—

The specimen is *Tragopogon porrifolius*, the Salsify or Vegetable Oyster, cultivated on account of its edible root. It is very seldom seen in Australian gardens. It is now and again seen as a stray from cultivation on the Downs, and, like chickory and some other plants, when it becomes wild the root is less esculent. We were quite pleased to get the specimen.

Plants from Winton Identified.

R.C. (Winton)—

The specimens have been determined as follows:—

Blennodia trisecta, a herb moderately common in parts of Western Queensland, but we have not heard a common name for it. It should be quite good fodder. The characteristic mentioned—that stock will not eat it until it is dry—seems to be a very common feature among Western Queensland plants. It would probably taint the milk of cows pretty badly, like most plants of the family, but this is not likely to worry you.

Zygophyllum glaucescens, Twin leaf. We were interested in your remarks that sheep eat the plant both green and dry.

Craspedia chrysantha, sometimes called Billy Button. We do not think there is any foundation at all for the belief that this plant causes blindness in horses.

Helychrysum podolepideum, a small species of the Everlasting family. If you could send us a larger specimen of this plant for our collections, the favour would be much appreciated.

Rhagodia linifolia, a plant of the Saltbush family. We should think that stock would eat this plant, particularly when it was drying off.

The Spanish Reed.

E.A. (Wondai)—

The specimen is not Pampas Grass, but *Arundo Donax*, the Spanish Reed, much cultivated as an ornamental grass in Australia and most warm, temperate countries. We have not heard of its being used as a fodder before, and on the whole it seems rather caney. If you are going to plant a small plot for trial purposes, however, it would be as well to cut the plant down every spring and let it shoot forth again. In the Southern States it is commonly called Bamboo, but is not a true Bamboo.

Rough Poppy.

A.W.J. (Lanefield)—

The specimen you send is one of the popies, *Papaver hybridum*, sometimes called the Rough Poppy. So far this poppy has not become a serious pest, at least in the lowland parts of the State. All of the membere of the poppy family are more or less suspected of being poisonous, as several of them contain alkaloids, such as morphine. However, so far as we are aware, no cases of poppy-poisoning have come under notice in this State. It is as well that you destroyed the plants you saw, as we already have too many weeds to cope with. *Papaver hybridum* has been recorded from the Darling Downs and the neighbourhood of Brisbane.

Caustic Vine.

A.F.M. (Hughenden)—

The specimen is, as you supposed, *Sarcostemma australe*, the Caustic Vine. This plant is widely spread through Queensland and Central Australia, occurring from the coast to the far interior. Reports regarding its poisonous character are very conflicting. It has even been spoken of in South Australia as quite good fodder. Feeding tests, however, recently carried out, definitely show that the poisonous properties generally ascribed to the plant in Queensland are founded on fact.

Buttercup Bush.

N.A.R.P. (Toowoomba)—

The specimen represents *Cassia eremophila*, commonly known as Buttercup Bush. It is a native of Western Queensland, is easily propagated from seed, and, we think, is worthy of a place in every garden. There were some fine plants of it growing in the Brisbane Botanic Gardens, but they died out and were not replaced. Like most Cassias, we think it wants replacing every few years.

Grasses Identified.

Fodder Project Club (Pullen Vale)—

Couch Grass (*Cynodon Dactylon*). This grass is widely spread over the tropical and subtropical regions of the world. It is a very nutritious grass, palatable to stock, but does not produce a great body of feed.

Buffalo Grass (*Stenotaphrum secundatum*). A native of tropical America now naturalised or cultivated in most warm countries. At one time it was used very extensively for lawns, but now is not used so much, its place being taken by the Blue Couch (*Digitaria didactyla*). It was one of the grasses grown many years ago on felled scrub areas, but is seldom seen now, except on old settlements, having given way to Paspalum, Rhodes, and other grasses.

Blue Couch (*Digitaria didactyla*). This grass is now very abundant in coastal Queensland. It is quite a good fodder, but is very dominant and apt to overrun pastures on better-class country where Paspalum and other grasses of higher-carrying capacity could be grown.

Red Natal Grass (*Rhynchelytrum roseum*). This is a native of Africa now widely spread over most tropical and subtropical countries. Reports concerning its fodder value are rather conflicting, but we do not seem to have a particularly good strain in Queensland. It is very common as a weed of cultivation on fruit farms in the coastal belt, and makes excellent "chop-chop" for horses and cattle, particularly when mixed with more palatable fodders.

Wild Sorghum.

W.S. (Spring Hill)—

The specimen of grass represents *Sorghum verticilliflorum*, commonly known as Wild Sorghum. It is an African grass, now very common in parts of Queensland, particularly along railway embankments, roadsides, cultivation headlands, &c. It is a perennial, and rather coarse in growth. It should be readily eaten by stock, but is strongly cyanophoric—that is, it contains quantities of a prussic-acid-yielding glucoside. This poisonous glucoside is present in a number of Sorghums, but is particularly marked in the present species. On the whole, its cultivation is not recommended.

Wall Barley.

O.G.S.M. (Warra)—

The specimen represents *Hordeum murinum,* the Wall Barley, a common European grass mostly met with in Queensland as a weed of cultivation. It is commonly seen around horse yards, &c., where feed has been spilt. It is of very little value as a fodder and should not be encouraged.

Sandalwood.

C.E.Y. (Noondoo Siding)—

The specimen bore neither flowers nor seed-pods. The bodies you took for fruit are really insect galls. We should say, however, that it represents the true Sandalwood (*Santalum lanceolatum*). The wood of this tree is largely exported from North Queensland, Thursday Island being the chief port of export. Until recent years we were always under the impression that the Northern tree alone had scented wood, but recently we have seen specimens from Charleville, Dalby, and other places in which the wood was quite scented. In these, however, the trees were very old and large, and the heartwood alone had any marked scent. Small trees, so far as we have observed, have no scent at all—at least, in the southern parts of the State. In Southern Queensland it is not often known as Sandalwood, but is most frequently known as Plum Tree owing to the little plum-like fruits is possesses. It is generally regarded as quite good stock food, and would have more value, we think, in the South from this point of view than for the actual wood. As you know, the name Sandalwood is generally given in Southern Queensland to a totally different tree—*Eremophila Mitchelli,* also found in New South Wales, where it is called Budda. This latter wood has met with no success as a substitute for true Sandalwood, but there does seem some future for it on account of the rich scented oil it contains.

Barbed Wire Grass. Spear Grass. "Black Heads."

T.F. (Goomeri)—

(1) *Cymbopogon refractus,* Barbed Wire Grass. The local name comes from the fact that the spikelets are reversed and occur in clusters along the flowering stem, giving it a superficial resemblance to barbed wire. It is a very common grass in parts of Queensland, but is only of secondary value as a fodder, and is left untouched when more palatable kinds are available.

(2) *Aristida ramosa,* a three-pronged Spear Grass. The local name comes from the fact that the seed is provided with three prongs or awns, which assist the plant in being carried about from one place to another. Aristida grasses are very common in parts of Queensland, and, on the whole, are not of much value as fodder. The spear-like seeds work their way under the skin of sheep.

(3) *Pappophorum nigricans* var. *arenicolum,* sometimes called Black-heads. It is a fairly common grass in some of the mixed native pastures of Queensland, and is probably of secondary importance, although grasses of this type are sometimes of value in making a mixture in the pasture.

Gall Weed. Yellow Daisy. Stagger Weed.

A.J.G. (Duleen, Tara Line)—

Your specimens have been determined as follows:—

(1.) *Zygophyllum apiculatum,* Gall Weed or Twin Leaf. A very common weed that overruns much of the Brigalow country in the mid-West. It is not known to be poisonous, though stock rarely, if ever, seem to touch it.

(2.) *Senecio lautus,* sometimes called Yellow Daisy in Western Queensland. It is very common in some parts, particularly on light forest soils bordering on to the Brigalow country. It seems to be eaten to a limited extent, and is not known to contain any harmful properties.

(3.) *Stachys arvensis,* Stagger Weed, sometimes also called Mint Weed, but not to be confused with the Mint Weed common in the Pittsworth district and to which a good deal of publicity has been directed. As the common name implies, the plant produces "staggers" or "shivers" in stock, but animals have to be driven, worked, or excited in some way before any symptoms are shown. Ordinary resting paddock stock, such as dairy cattle, calves, &c., feed on the plant with impunity.

Sun Hemp.

E.R. (Ambrose)—

Your specimen represents *Crotalaria juncea,* the Sun Hemp, sometimes also known as Rattle-pod, a name applied in general to members of the genus Crotalaria. It is a native weed but is widely spread through the Malayan Region to India. In India a form of the plant is cultivated for fibre, the treatment being somewhat the same as that accorded to flax. It is also valuable as a green manure. We have no record of the plant's effect on stock, but in view of the fact that several members of the genus Crotalaria, both in Australia and abroad, have been proved definitely poisonous to stock, it is as well to regard it with suspicion. We do not think the plant has any economic value in Australia.

Date Palms. Coconut Palms.

A.L. (Gunalda)—

You should be able to obtain date palms and possibly coconut palms from the Curator, Botanic Gardens, Rockhampton, as this institution makes a practice of selling plants. If the Curator at Rockhampton does not have coconut palms, they should be obtainable from the Curator, Botanic Gardens, Townsville. We think this institution also sells plants.

In getting date palms, it is best to get suckers from the female tree, as the male flowers and female flowers are on different trees, the female, of course, only bearing fruit. In the cultivation of dates for drying, the female flowers are generally artificially pollinated, but this is a very simple business. Ordinary dates often come up about places where seeds have been accidentally thrown and really germinate quite well; so if you are not particular about being sure of male and female plants, you could probably raise your own plants from the seeds of ordinary packet dates.

Coconut palms can be raised by placing the whole coconut, including the dry husk, either sideways in the soil or burying about two-thirds or three-quarters under the ground, the sharp end downwards.

Weeds from Gayndah Identified.

W.S.K. (Gayndah).—The Bundle of specimens taken from your farm have been determined as follows:—

(1) *Rumex crispus,* Curled or Yellow Dock. A very common weed in Queensland not known to be poisonous or harmful in any way.

(2) *Stachys arvensis,* Stagger Weed or Wild Mint. This plant is quite a good fodder for dairy cows and ordinary resting paddock stock, but gives working horses or travelling stock "shivers" or "staggers." Animals recover, however, if taken off the plant and put on to ordinary feed. It is not to be confused with the Mint Weed to which so much publicity has been given in the press during the last couple of years, and which is of rather greyish appearance with spikes of bluish flowers.

(3) *Rahpanus Rhapanistrum,* Wild Radish or Jointed Charlock, mostly known in Queensland as Turnip Weed. It taints the milk of dairy cattle very badly, but we do not think it is as bad as Nos. 4 and 5.

(4) *Senebiera didyma,* Bitter Cress or Wart Cress. A very common weed in Queensland and one of the very worst we have to taint the milk of dairy cattle.

(5) *Lepidium ruderale,* a Pepper Cress. Like other members of the family Cruciferæ, it is commonly known in Queensland as Mustard Weed or Turnip Weed. It is a very bad weed to taint the milk and cream of dairy cows.

Nos. 3, 4, and 5 are not known to possess any poisonous properties.

Birds'-Foot Trefoil.

J.B.K. (Kilcoy)—

The specimen is a species of lotus or bird's-foot Trefoil. From the small specimen submitted we should say it was the native species, *Lotus australis,* moderately common in some places and generally regarded as quite a good fodder. In New South Wales it is sometimes called Barwon lucerne. Stock are fond of the plant, but like most of the bird's-foot trefoils it contains a prussic-acid yielding glucoside, although trouble from the plant seems to be very rare.

Pandanus.

C.F.J. (Pialba)—

The common "Breadfruit Tree" of Fraser Island and other parts of the Queensland coast is a species of Pandanus. It is a totally different plant to the true Breadfruit of the South Sea Islands, which is *Artocarpus incisa*, a tree very closely allied to our familiar Jak-fruit. We do not know how the name came to be applied to the Pandanus except that the head of fruits is big and perhaps superficially resembles that of the true Breadfruit. The true Breadfruit or *Artocarpus* is, of course, a very important article of diet on all the islands of the South Seas. There are numerous varieties, the best ones being seedless, and the tree is easily propagated from cuttings. It was introduced into North Queensland some years ago, and there were good trees growing at the State Nursery at Kamerunga, although we have not seen one in Queensland for some time past.

Wall Barley. Whiteheads. Prairie Grass. Hexham Scent. Burr Trefoil. Prickly Lettuce. Improvement of Carrying Capacity.

J.F.K. (St. George)—Your specimens have been determined as follows:—

1. *Hordeum murinum*, Wall Barley; moderately common as a weed during the winter and spring months. It dies out on the approach of hot weather. It provides a bit of food when young, but soon becomes unpalatable and of very little value as a fodder.

2. *Pappophorum avenacea*, Whiteheads; a fairly common grass in parts of Queensland. We were very interested in your remarks that it was ousting the wire grass on the red loam soils on your property. This is very important. The only drawback is that so far as our experience goes *Pappophorum* grasses on the whole are rather unpalatable. What is your experience with the present plant? Could we have a specimen of your wire grass to determine the actual species? The name "Wire Grass" is given in Queensland mostly to the species of *Aristida*. They are very abundant on the lighter soil of the Western Darling Downs and Maranoa districts, and although edible in their younger stages, they soon become harsh and unpalatable. Bullocks will eat them, however, when driven on to them by hunger and the absence of other food.

3. *Bromus unioloides*.—This is the common prairie grass cultivated in Queensland. It is one of the best of the winter grasses, but on the whole seems to want cultivation to succeed well. It is quite a common thing to see it come up spontaneously around homestead gardens. When spread in the brigalow country it carries on for several years, re-seeding itself, but eventually becoming more or less confined to the melon holes.

4. *Melilotus parviflora*, the Melilot or Hexham Scent. Some years ago this plant was boomed as a fodder under the name of King Island Melilot. So far as our experience goes, however, stock do not take to it very readily. It also taints milk very badly if cows feed on it to any extent, but beyond that it does not contain any harmful properties. The seed sometimes contaminates wheat, giving an objectionable odour and flavour to the flour.

5. *Medicago denticulata*, a Burr Trefoil; one of the best of the annual trefoils and clovers. The only disadvantage is that the burrs are troublesome in belly wool of the sheep. Stock on the whole seem to prefer the plant when it is dying off somewhat, to when it is green and luxuriant.

6. *Lactuca scariola*, Trickly Lettuce; rather a bad farm weed in some parts of Queensland.

The question raised by you as to the possibility of improving the carrying capacity of much of the Western Darling Downs and Maranoa districts at present covered by Wire Grasses is an extremely important one and worthy of attention. Some time ago the Department supplied from the State farm at Bungeworgorai a number of roots of Woolly Finger Grass (*Digitaria eriantha*) to Dr. Hirschfeld for the same purpose; that is, the running out of the Wire Grass by another and more vigorous-growing species. Dr. Hirschfeld tells us that the Woolly Finger Grass is doing better on the sandy soils infested with Wire Grass than it is on the heavier black-soil country.

Macrozamia.

J.R. (Yeerongpilly)—

The specimens collected near Springsure represent *Macrozamia Moorei,* very common in that district. Its effects on horses are said to be that they stagger somewhat in their front legs and step high. They eventually go almost blind from the effect of the plant. Trouble is caused in two ways, mostly from stock eating the young plants, and sometimes from their eating the fallen seeds. In cattle the symptoms are somewhat different, rickets and loss of control of the hindquarters being frequent symptoms.

Trees Suitable for the Callide Valley.

O.W. (Biloela)—

Following is a list of trees that should grow in your locality:—Burdekin Plum Mango (worth trying if your winters are not too severe); Coral Tree (Erythrina); Poinciana (the same remarks apply as to the Mango); Jacaranda; Algaroba Bean; Camphor Laurel; Silky Oak; *Celtis sinensis,* deciduous, commonly called Box Elm, in our opinion one of the handsomest trees for a position such as yours and it also has the advantage that the leaves are good fodder for stock; Phytolacca or Bella Sombra Tree, a very quick-growing species with a very spreading, gouty stem; the leaves are quite good fodder for stock; pines of various sorts (probably the best for your purpose would be the long-leaved Chir pine, *Pinus longifolia,* Torulosa Pine, *Cupressus torulosa*), Cotton Palm, *Washingtonia,* Wine Palm, *Coccus Yatay.* The nearest source of supply of young trees would probably be the Botanic Gardens, Rockhampton, and we would advise you to get in touch with the curator. If you wish to raise the trees yourself from seed, the seeds should be sown in flats or prepared beds, then preferably put into pots or old tins and eventually planted out into their permanent situations. It is getting rather late for planting this season, although the more tropical types of plants such as the Burdekin Plum, Mango, Coral Tree, and Poinciana are best planted now.

Windbreaks at Jandowae.

C.W.McG. (Brisbane)—

Regarding trees suitable for growing as a windbreak for dairy stock in the Jandowae district, we think one of the pines would be as satisfactory as any; we take it that a fairly quick-growing tree is required. Of these, we would recommend either the Insignis pine (*Pinus radiata*) or the *Torulosa* pine (*Cupressus torulosa*). Both are obtainable in quantities from most nurserymen. The Torulosa pine is a species of Cypress pine, and varies a good deal in character. For ordinary purposes, such as a windbreak, seedling trees should suffice, but, of course, they do not come true to type. Trees raised from cuttings are more reliable in this respect, but are more expensive.

Woolly Clover.

W.S. (Cooyar Line)—

The specimen represents the Woolly Clover (*Trifolium tomentosum*), an annual clover that is now and again seen growing spontaneously in parts of Southern Queensland. It grows during the winter and spring months, dying off with the approach of the hot summer weather. We have little knowledge of its value as a fodder, but most of these annual clovers are of value as they come in at a time when grass is short.

Bitter Pitted Blue Grass. Rat's Tail Grass.

T.G. (Nerang)—Your specimens have been determined as follows:—

1. *Bothriochloa decipens,* Bitter or Pitted Blue grass, also known as Red-leg or Red grass. Our general experience with this grass is that it has very little value as a fodder, and stock do not take to it unless driven by hunger or absence of other feed. The Blue grass about Miles you refer to is *Dichanthium sericeum.*
2. *Sporobolus Berteroanus,* Parramatta grass or Rat's Tail grass, a native of South America now naturalised in most warm temperate countries. It has caused some concern in some of the coastal districts as an invader of the Paspalum pasture.

Cockspur Thistle ("Saucy Jack.")

W.B. (North Tamborine)—

The specimen represents the Cockspur Thistle (*Centaurea melitensis*), a native of Southern Europe, now a common naturalised weed in many warm temperate countries. We think it is much more abundant in the Southern States than in Queensland, and here it is mostly found on the Darling Downs. It is a very bad weed in parts of New South Wales, and is commonly called "Saucy Jack." The plant is said to have some fodder value in its younger stages, but to be soon neglected by stock. Its destruction is recommended.

European Bindweed.

H.J. (Stanthorpe)—

Your specimen represents *Convolvulus arvensis,* the European Bindweed, a particularly pernicious pest once it gets into cultivation. It is fairly common in some of the Southern States, but up to the present it has not much of a hold in Queensland. We have had a few specimens from the Darling Downs, but this is the first time from the Granite Belt. Every effort should be made to eradicate it. A leaflet on the weed has been posted to you.

Yellow Dock.

M.D.O'D. (Gympie)—

The specimen represents *Rumex crispus,* the Yellow Dock or Curled Dock, a common European plant now abundant as a naturalised weed in many parts of Australia. It is quite a common weed in Queensland on cultivation areas and waste places such as town allotments, &c. It is not known to possess any harmful or poisonous properties.

English Meadow Grass.

E.G.T. (Maleny)—

The specimen is *Poa annua,* the English Meadow Grass, a common European grass now fairly common in many parts of Queensland. It is particularly abundant during the late winter and spring months, and dies out on the approach of hot weather. It is quite a useful fodder while it lasts. It is more often seen as a weed of cultivation than in the pasture, although of recent years it seems to have invaded some of the pastures in the coastal belt.

Canary Grass.

C.A.M. (Cooroy)—

The specimen represents the common Canary Grass (*Phalaris canariensis*). This grass is mostly grown for canary seed rather than as a fodder. Two other Canary Grasses are grown in Queensland, namely *P. minor* (annual) and *P. tuberosa* (perennial). The latter is an excellent fodder grass, especially valuable during the winter months. Seeds of Canary Grass should be sown preferably in April or May.

Useful Shrub for Coastal Lands (*Vitex trifolia*).

A.C.H. (Bowen)—

The shrub *Vitex trifolia* is a common native seaside shrub in Queensland. It is a particularly valuable shrub for planting in coastal areas to stop sand drift. There are several forms in North Queensland; one creeps over the sand, and this form is very abundant on the esplanade at Townsville; you probably also have it at Bowen. The form most favoured for planting is a shrubby one generally growing about 6 to 8 feet high. The leaves are green above and generally whitish beneath. The flowers are blue, the berries at first green and eventually black. It can be propagated from seed, but should strike quite readily from cuttings. A variegated form, variety *variegata,* is moderately common in Queensland gardens. In regard to the roots you have, if you want to make a hedge of these I would plant them about 3 feet apart. The present time is a very suitable one for doing the work, but if the weather is at all dry the plants should be kept watered and preferably mulched for a week or more after planting.

Johnson Grass.

W.P.C. (Roadvale)—

The specimen represents the Johnson Grass (*Sorghum halepense*), mostly seen in Queensland as a weed of cultivation. When once it gets into a cultivation it is difficult to eradicate. It is a moderately good fodder, but like other members of the Sorghum family contains a prussic-acid yielding glucoside, and therefore must be fed with care. Cutting and allowing the plant to wilt renders it safer. Pigs are very fond of the white underground runners, and though they are often eaten by them without harmful results we have heard of cases of death resulting, as these runners contain the same poisonous principle as the green leaves.

"Wild Lucerne." ***Sida retusa.***

T.G. (Nerang)—

The Wild Lucerne of Brunette Downs is *Psoralea cinerea*, a native of the Northern Territory and North-western Queensland. It is much more of a lucerne-like plant in appearance than the *Stylosanthes*, growing upright and not trailing along the ground. The so-called Wild Lucerne of Darwin is the same as the "Townsville Lucerne." The correct botanical name is *Stylosanthes sundaica*, the other name (*Stylosanthes mucronata*) being merely a synonym. By the rules of botanical nomenclature the name *sundaica* has priority and has got to be used. We hope this clears up the matter.

Sida retusa is quite a good stock feed, although I do not know that it has been analysed to find its actual food value. In parts of New South Wales it is very abundant, and is commonly known as "Paddy's lucerne." I do not know that it would have any effect on stock. The leaves are somewhat mucilaginous when chewed and may assist in passing dry fibrous food. The stems of *Sida retusa*, of course, are exceedingly fibrous.

Henbit or Dead Nettle.

J.B. (Chinchilla)—

The specimen represents *Lamium amplexicaule*, the Henbit or Dead Nettle, a common weed of the Northern Hemisphere now quite common in many parts of Queensland and the Southern States. It is closely allied to the common Stagger Weed, and like that plant is capable of causing "shivers" or "staggers" in stock. The animals, however, have to be worked, driven, or excited in some way before any symptoms are manifested. For ordinary paddock resting stock such as calves and dairy cattle the plant is quite good fodder.

Whitewood and "Walk-about" Disease.

C.W. (Butcher Hill)—

The Whitewood is a small tree fairly abundant in many parts of Queensland, stretching through the Northern Territory to the Kimberleys in Western Australia. We have posted you under separate cover a small branchlet showing the leaves. The tree bears a mass of small white flowers, and these are followed by very characteristic winged "seeds." It would be interesting to know if this tree occurs in your locality. Although the case seems definitely proved against Whitewood, many stockowners and veterinarians are of the opinion that Whitewood is not the only cause of the "Walk-about" disease common in parts of Northern Australia. One of the reasons given for this is that "Walk-about" disease occurs where Whitewood is absent or at most rather rare.

A Common Pasture Herb.

H.P. (Kolan River South)—

The specimen is *Geranium dissectum*, a very common pasture herb in Queensland and New South Wales. On the Darling Downs and inland pastures generally it is most frequently referred to as Crow's-foot, and is favoured by sheep. In addition to the leafy foliage the older plants possess a small, carrot-like root which is relished by stock, particularly sheep. The herb is sometimes seen in the mixed native pastures on the coast, but stock do not seem to take to it readily as they do in the inland parts of the State. Perhaps the plant makes a ranker growth on the coast, and is consequently less palatable.

General Notes.

Staff Changes and Appointments.

Mr. A. E. Mitchell, Slaughtering Inspector, Warwick, has been appointed also an Inspector under the Diseases in Stock Acts.

Mr. A. J. Hicklin (Sandgate) and Mr. E. L. T. Boyce (care Main Roads Commission, Brisbane) have been appointed Honorary Rangers under the Animals and Birds Acts and the Native Plants Protection Act.

Mr. C. P. Joyner, Inspector of Stock, Cooyar, has been appointed also an Inspector under the Dairy Produce Acts.

Mr. J. Wyvill, Inspector of Stock, Nanango, has been appointed also an Inspector under the Slaughtering Act.

Mr. E. R. Boyd, Inspector of Dairies, Nanango, has been appointed also Inspector under the Diseases in Stock Acts.

Mr. P. P. Comiskey, Inspector of Stock, Boonah, has been appointed also an Inspector under the Dairy Produce Acts.

Mr. T. Brett, Inspector of the Moreton Rabbit Board, attached to Mount Lindesay, has been appointed an Honorary Ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Mr. E. R. Cronau (Newmarket) has been appointed an Inspector under the Diseases in Stock Acts, the Slaughtering Act, and the Dairy Produce Acts, Department of Agriculture and Stock.

Mr. R. B. Norwood, Assistant Pathologist, Department of Agriculture and Stock, has been appointed also an Inspector under the Diseases in Plants Acts.

Mr. G. W. J. Agnew, Inspector under the Diseases in Plants Acts, has been appointed also an Agent under the Banana Industry Protection Act.

Messrs. J. J. Shelvey and J. Bishop, Inspectors of Stock at Helidon and Kingaroy, respectively, have been appointed also Inspectors under the Slaughtering Act.

Messrs. J. A. O'Neill and D. J. Callaghan, Dairy Inspectors at Gayndah and Mundubbera, respectively, have been appointed also Inspectors under the Stock and Slaughtering Acts.

Mr. J. P. Dowling, Stock Inspector, Gayndah, has been appointed also an Inspector under the Dairy Produce Acts.

Mr. R. E. Watson, Inspector under the Stock, Slaughtering, and Dairy Produce Acts, has been transferred from Toowoomba to Goombungee.

Mr. J. Macdonald, of Ayr, has been appointed an Honorary Ranger under the Animals and Birds Acts in connection with the recently declared sanctuaries on Hamilton and Henning Islands.

Mr. A. M. Richardson (Burleigh Heads) has been appointed an Agent under the Banana Industry Protection Act and Inspector under the Diseases in Plants Acts, and will be stationed at Stanthorpe.

Senior Sergeant G. P. Keeffe (Warwick) and Acting Sergeant O. Murphy (Esk) have been appointed also Inspectors under the Slaughtering Act.

Mr. E. G. Lawrance (Maleny) and Mr. E. Teitzel (Mount Mee West) have been appointed Honorary Rangers under the Animals and Birds Acts and the Native Plants Protection Act.

Constable C. J. Munro (Nebo) has been appointed also an Inspector under the Brands Acts.

Mr. H. Collard, Assistant Instructor in Fruit Culture, has been transferred from Cardwell to Maryborough.

Election of Mill Suppliers' Committees.

Existing regulations under the Primary Producers' Organisation and Marketing Acts relative to the election of Mill Suppliers' Committees and District Cane Growers' Executives have been rescinded, and new regulations issued in lieu thereof. The present method of optional preferential voting for Cane Growers' Association elections is considered unsatisfactory, and accordingly new regulations providing for a system of compulsory preferential voting have been promulgated.

In Memoriam.

KEITH LOCKWOOD GRAHAM.

The announcement of the death of Mr. Keith Lockwood Graham on 11th October was received with profound regret in the several country districts of Queensland in which he had served as manager of branches of the Bank of New South Wales.

The late Mr. Graham was the first manager of the Bank of New South Wales at Murgon, then little more than a name on a railway map. In the early days of that fertile and now very prosperous section of the rich South Burnett, he was among the pioneers of every progressive movement and an influence for good in the business and social life of the youthful community, assisting greatly in its rapid development. As a capable banker and as a guide, philosopher, and friend to the pioneer settlers, his worth was widely recognised.

Mr. Graham was afterwards appointed to the management of the Cooktown and Samarai branches of his bank. In 1922 he was transferred to Eumundi, where he remained for eight years. On 11th October, 1930, an attempt was made by armed burglars to rob the bank. With remarkable coolness and courage, Mr. Graham frustrated the attempt, but was shot twice and dangerously wounded. (It is a coincidence that he died on the corresponding date four years later.) On recovering he was transferred to the Brisbane district relieving staff, and later to the position of manager of the Mount Gambier branch, South Australia. He was afterwards appointed relieving manager in Victoria. Not long ago he became ill and returned to Queensland. He was fifty-five years of age, and unmarried.

Mr. Graham belonged to a well-known Queensland family, who were pioneers in the pastoral industry. He was a native of the Darling Downs, and was educated at the Toowoomba Grammar School. A brother was among the first Australian Light Horse officers to be killed at Gallipoli.

Mr. Graham was a fine cricketer in his younger days, and played for Toowoomba against the late A. E. Stoddart's English Eleven. He also excelled at tennis. To his bereaved relatives deep sympathy is extended.

Slaughtering Regulation.

Regulation No. 39 under the Slaughtering Act has been reissued in a form which now makes it quite clear that the occupier of a butcher's shop shall be the person responsible for seeing that the shop is provided with wire gauze to exclude flies, and to ensure that the doors are kept closed except when in use for ingress or egress.

Hail Insurance.

An amendment of the Hail Insurance Scheme Regulations issued under the Wheat Pool Acts has been approved which will provide that returns for hail compensation shall be lodged with the Wheat Board on or before such day, but not later than 15th September in the year in which the crop is grown, as the Board may determine. The regulation previously provided that returns should be lodged on or before the 15th August in each year.

The Broom Millet Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts, giving notice of intention to extend the operations of the Broom Millet Board for the period from 1st November, 1934, to 31st October, 1937. A petition on the question of the continuance or otherwise of the Board may be lodged by growers on or before the 24th September, 1934.

Deloraine Island a Sanctuary.

Deloraine Island, near Whitsunday Island, Great Barrier Reef, has been declared a sanctuary under the Animals and Birds Acts.

Rolleston-Injune Road a Stock Route.

An Order in Council has been issued under the Diseases in Stock Acts, declaring the Rolleston-Injune road to be a stock route for the purposes of the said Acts. This road was recently opened, by Proclamation under the Lands Acts, as a public road, and may in future be used as a stock route for travelling stock.

The Pig Industry Act.

Executive approval has been given to the issue of a Proclamation bringing "*The Pig Industry Act of* 1933" into operation as from the 23rd August.

Regulations have been approved under the Act, and these cover the examination of graders and inspectors, the grading of carcasses, the management of piggeries, grade definitions, grade certificates, check grading, grade marks, and condemnations.

Tobacco Pure Seed District near Rockhampton.

An Order in Council has been issued under the Tobacco Industry Protection Act constituting a Tobacco Pure Seed District which comprises the area contained within the boundaries of the parishes of San Jose and Ultimo, in the county of Deas Thompson. This district embraces Marmor and Bajool, near Rockhampton.

Sanctuaries in Whitsunday Passage.

An Order in Council has been issued under the Animals and Birds Acts declaring Hamilton and Henning Islands, Whitsunday Passage, to be sanctuaries under the Animals and Birds Acts. It will be unlawful in future to shoot any native animals or birds on these islands.

Provisional Maize Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts amending the constitution of the Provisional Maize Board by extending the term of the Board for a further twelve months. The Board was constituted in October, 1931, for twelve months, and was extended for a similar period in November, 1932.

Fruit Fly in Granite Belt.

A Proclamation has been issued under the Diseases in Plants Acts declaring the Stanthorpe, Killarney, and Warwick districts to be a quarantine area on account of the disease of fruit flies. A Regulation has also been approved under the Acts prescribing the nature of the quarantine to be imposed therein. It will be necessary for orchardists in the districts mentioned to place traps charged with fruit fly lure approved by an Inspector throughout their orchards. The regulation will be in force for the period from 8th October, 1934, to 28th February, 1935.

Citrus Fruit Lands of the Burnett.

The Minister for Agriculture and Stock (Hon. F. W. Bulcock, M.L.A.) stated recently that he had received a report from the Director of Fruit Culture (Mr. H. Barnes) covering a survey of the Mundubbera district from the aspect of commercial citrus growing.

The report indicated that along the banks of the Auburn, Boyne, and Burnett Rivers there are many acres of suitable citrus soils, ranging from deep sandy soils to chocolate and redy sandy loams. Where the subsoils are of sufficiently open texture to obviate any danger of the retention of excessive moisture, the loamy soils are to be preferred. Good supplies of river water are available for irrigation, without which the cultivation of this fruit should not be attempted in the drier regions.

On the Curgeena and Binjour plateaux the soils are mainly chocolate and red loams, but as there is an absence of water and the rainfall is irregular and insufficient commercial orchards should not be planted.

Of course, added the Minister, every care should be exercised by intending orchardists when determining the site of the grove, and in this connection planters would be well advised to seek the advice of Departmental Instructors, who are always willing to assist in every possible way.

The varieties recommended for the main plantings are Washington Navel and, to a lesser degree, Valencia Late. In warm situations free from frost the Villa Franca and Lisbon Lemons will do well, as also will the Beauty of Glen Retreat Mandarin.

Rural Topics.

Care in Handling Pigs.

Under normal conditions around the farmyard, and all other things being equal, it is reasonable to consider the domestic pig as being of even, contented temperament —an animal, who, though stubborn by nature, is easily handled if given reasonable care. A report published recently of a young man at Skyring's Creek, Pomona, being attacked by a boar and receiving nasty wounds as a result of the boar using his sharp tusks and teeth too freely indicates the urgency of being ever careful when feeding and attending to this class of animal. No mention was made of any extenuating circumstances in the case referred to, but it often happens that a boar pig (in particular) comes in for rather bad treatment at the hands of farmers who are short-tempered themselves, and thus when both the attendant and the animal become excited an accident is almost certain to occur, and, if it does, the strongest and the quickest wins. Boars should not be permitted to run with sows and other pigs, but should be kept in a properly constructed boar yard, into which no one should enter without providing himself or herself with a stout cane with which to protect one's self if need be.

It is an offence under the Pig Industry Act to ill-treat a pig in any way and to beat a pig with a whip, stick, or other instrument capable of bruising or damaging the carcass of such animal; hence the added necessity for care in handling, to avoid any call for rough treatment on the part of either man or beast. If reasonable precautions are observed, there is little risk of trouble. However, it is a wise procedure, and not an impossible one, to remove the sharp tusks of the boar pig before he reaches the age of one year, or to remove them if they have grown and the animal is over twelve months of age. A pair of blacksmith's bolt-cutters is the safest and best instrument to use in removing the tusks, and to do this, of course, necessitates tying the animal up to a very stout post or rail. It is a very wise thing to nip off the sharp black teeth of sucking pigs before they are one month old, for, although they are only small, they can do a great deal in irritating the sow if they fight, and lacerate her teats with the sharp black teeth which they possess. After removal of the tusks or teeth, ordinary care only is necessary to prevent infection.—By E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

Triumph of Herd Testing.

All thoughtful and far-seeing dairy farmers have always rightly believed that persistent herd testing was the main foundation of successful dairy farming. Further proof of that contention has just come to hand from the South Taranaki Association, and it reveals a success of which any association in the world might be justly proud.

Not so many years ago an occasional average record of 300 lb. butterfat per cow was considered a wonderful result; but the South Taranaki Association has been aiming at an average of all cows tested within its bounds of 300 lb. It was a great object, thought by many to be unattainable, but it was successfully attained last season. The result is all the more remarkable for the reason that a fair number of cows did not yield a great deal more than 200 lb. of butterfat each.

Herd testing is a fruitful source of many desirable changes in dairy farm management, not the least important being the stimulation of the competitive spirit. Great results from one association spur others to make greater efforts, and, hence, are a source of all-round improvement. A general improvement in herd treatment is brought about, as it is soon realised that an increase in the herd average yield is not possible except there is first a general improvement in the management of the herd. It necessitates greater care in breeding, feeding, culling, sheltering, pasture topdressing and general pasture management.

Unfortunately the prospect of quotas or other restrictions on the export of butter, cheese, and by-products of the dairy farm may cause great discouragement to many farmers, and induce them to conclude that higher butterfat averages are of little value when the increase cannot be marketed. That such a conclusion is wrong should be obvious; indeed, the effort to bring about a higher average production should be intensified, not to increase the quantity of produce for export, but to enable farmers to decrease the number of cows in their herds very considerably, so that part of the land would be available for some other branch of farming; or, in other words, so that twenty cows would produce the quantity of butterfat that is now produced by twenty-five to thirty.—Primrose McConnell in the "New Zealand Farmer."

Cultivation of Maize.

In the production of maize the cultivation of the growing crop is essential for two main reasons—firstly, for the destruction of weeds, and, secondly, for the conservation of soil moisture. Harrowing the young crop is the first necessity, as it destroys young weed growth, particularly in the rows, aerates, warms and mulches the soil, and gives the young plants a quick start. As the crop grows it should be inter-row cultivated whenever weeds appear or the soil becomes crusted.

The depth of cultivation is very important. Cultivation of the established plants must not be too deep. No harm is done if deep cultivation is practised in the early stages of growth, provided it is not too close to the plants, but from when the plants are 18 to 20 inches high only shallow cultivation should be given, as, the plant being a surface feeder, the roots extend across the rows and within 3 or 4 inches of the surface.

The disadvantages of hilling outweigh the advantages, and as a general practice it cannot be recommended. A light hilling may sometimes be necessary to smother weed growth or as an aid to drainage on low-lying lands, but the damage done to roots, the possibility of "gullying" on slopes, and the greater surface exposed for evaporation are all against the practice, while the support given to the stalks by hilling is not so important as is usually thought. Throwing a big hill with the plough as still often practised cannot be too strongly condemned.

It is not necessary to remove the suckers from growing maize crops. This practice, adopted by many farmers with the idea of increasing yield and incidentally providing a little fodder for stock, actually decreases the yield, as proved in an experiment conducted at Grafton Experiment Farm (New South Wales) over a period of four years.

Safe Working of Farm Machinery—Some Vital Safeguards.

An accident which occurred recently to a young girl, whilst she was attending a power-driven separator on her father's farm, draws attention to the necessity for the adequate protection of milking machinery. This girl was partly scalped through her hair, which she was wearing long, being caught up by a belt, only 1 in. wide, transmitting power to the separator. In another case, it was found necessary to amputate the left leg of a man who had been caught in the belting of a milking machine.

Moving belts are responsible for most of the accidents with milking machinery. Often the victim is struck by the projections on metal belt fasteners, or is trapped at the intake of the belt with the pulley.

All belting within reach from the floor should be fenced. The habit of shifting belts by hand is dangerous. The use of a belt pole or stick is less dangerous, but mechanical means for shifting the belt are the safer. If metallic fasteners without dangerous projections cannot be obtained, the most convenient, and at the same time, a safe fastening, is a well-made leather-laced joint. Perches or hangers should be provided for belts in order to prevent them riding on the shaft when they are unshipped.

Another hazard of milking machinery is revolving shafting. Whilst shafting accidents are not so frequent as belting accidents, they are the more serious, and several fatalities and serious accidents have occurred. Many people are deceived by revolving shafting because it looks so smooth. However smooth it is it is capable of catching up anything loose, such as, for instance, aprons, ragged sleeves, hair, cleaning waste, &c. The hazard of revolving shafting is greater at higher speeds, but fatal accidents have occurred at shafts running at a few revolutions per minute. All exposed shafting, or shaft ends, should be protected, and projecting key heads in couplings and pulleys, projecting bolt heads and nuts in couplings, projecting set screws on shaft collars, and all other projections liable to catch in clothing should be eliminated or protected, unless they are out of reach and, therefore, safe by position. No shafting is considered safe by position, unless it is at least 6½ ft. above the floor, or from any point to which persons may have access whilst the shaft is in motion. The arms of wheels and pulleys within reach should also be fenced, or fitted with solid discs. Gear wheels should be encased in metal guards; partial guards are inadequate and may be dangerous.

There appears to be a general impression that, as all small farming machinery is exempt from inspection under the Inspection of Machinery Act, the owner is not legally obliged to guard it. This impression is quite erroneous. Any owner of power-driven milking machinery who permits any moving part of it to be used without being so guarded as to afford adequate protection to all persons working the machinery, or who may be in the vicinity thereof, is liable to a fine not exceeding twenty pounds. Further, an Inspector of Machinery has power to require the owner to desist from working or using any milking machine which is defective, or insufficiently fenced or guarded, until the requirement of his Department have been complied with.

If farmers wish to be completely successful in the prevention of accidents, it is necessary that they should supplement the provision of mechanical safeguards with a strict enforcement of certain rules of safe practices in the working of machinery. Some of the most important of these rules are:—

1. Never reach into moving machinery.
2. Stop the machine if it is necessary to approach any moving part which is not guarded or fenced.
3. Do not ship or unship moving belts directly by hand.
4. Do not permit loose belts to rest on revolving shafting.
5. Do not oil bearings in the vicinity of unfenced belts, shafting, or gear wheels, when the machinery is running.
6. Do not clean shafting, examine, or repair machinery when it is in motion.
7. Wear safe garments when attending moving machinery. A single-piece, close-fitting suit of overalls is safer than overalls consisting of separate coat and trousers. Pockets should be few and small, and sleeves should be tight at the wrist. If sleeves are not desired, they should be removed at the shoulder, or at the place to which they would be rolled up. If removed, the edges should be hemmed. Sleeves should not be worn rolled up because they then offer considerable resistance if caught in machinery. Do not wear loose or ragged clothing; nor loose aprons; neckties, if worn, should be enclosed.
8. Insist on any woman or girl working at milking machinery having her hair put up or enclosed in a net.
9. Never allow children to enter the shed in which the milking machinery is installed. Keep the door locked and the key out of their reach.
10. Even though the machine may be a small one, do not be careless when attending it.

The above precautions are, in the light of present-day experience, essential if accidents are to be prevented. The accident hazard of farm machinery is greater than it is generally supposed to be. A "safety first" policy will pay financially and socially. A moment for safety is better than a month in bed for repairs.—The "New Zealand Farmer."

Importance of a Good Bull.

A sire of unquestionable quality is essential if dairying is to be carried on with maximum profit. Referring in the course of his report, a judge of a recent North Coast (N.S.W.) dairy farm competition observed:—The herds seen were generally of a high standard as regards quality and type. It is very disappointing, however, to see so many farmers using herd sires which have no direct production backing. This requirement has been given publicity and advocated for so long that failure to observe it cannot be a matter of ignorance, yet the dairy farmer who places at the head of his herd a sire from untested stock is deliberately taking a thousand-to-one chance of his being able to improve the herd's average butter production.

Some farmers in the competition have carefully culled and tested their herds for years, bringing them to a fairly high standard, and then purchased a pure-bred bull from an untested dam, thus risking the work and expense of years. To "breed, weed, and feed" is an old slogan in the dairying industry, but no two of these three practices are of their full value without the other one.

How to Renew Old Cultivator Points.

Do not throw away your old cultivator points, for with a little attention they can be made as good as new again, a correspondent advises fellow-farmers in the "Agricultural Gazette" of New South Wales. Put them in the forge, heat to a nearly white heat, flatten out portion of the turned-up parts, and cut sides down to a V-shape. Then sharpen (by hammering) the cutting edges, like a wood-chisel, heat in the fire until a *slight* tinge of red appears in the steel, then immerse in sump oil for about half a minute and throw out to cool. This will give just the right temper—tough and hard. For very worn points, punch a new hole near one end, and they will be nearly as good as new.

Make your own cultivator points from old discs; there is nothing better, and they will outlast two sets of bought ones.

How to Cut a Rafter.

Many a farmer, in building any of the various small farm buildings, has no difficulty until he comes to laying out the rafters. Yet this is not a very hard matter once one takes a little time to think the problem through.

First, we should get clearly in mind the parts of the rafter. The first illustration herewith will make this clear. The plumb cut is where the two rafters meet at the peak of the roof. The seat cut is where the rafter rests on the wall plate. The plumb cut is always vertical, the seat cut is always horizontal.

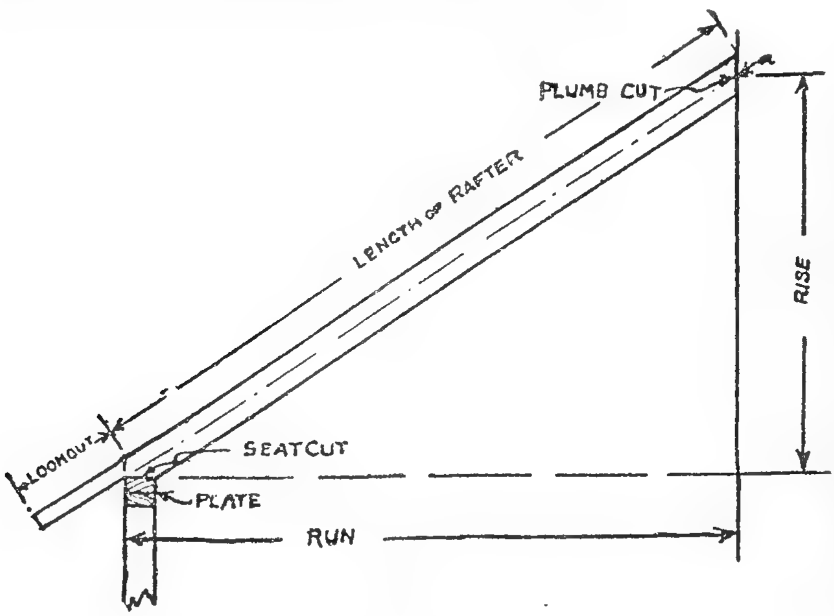


PLATE 277.

The run is the horizontal distance under the rafter, while the rise is the vertical height from the plate line to the point where the dotted line which touches the outside corner of the plate passes at "A" through the plumb cut. The run is half the width of the frame of the building. The term "length of rafter" refers to that part which covers the building, while the lookout is that part which projects beyond the side of the building.

Let us now take a practical problem and lay out a common rafter. All that is necessary is a steel square and a sharp pencil. Suppose we are building a garage 12 feet wide and want to use a ⅓ pitch roof. The rise of the rafter will be ⅓ of 12, or 4 feet, and the run will be 6 feet. If the rise is 4 feet, or 48 inches, for a 6-foot run it will be ⅙ of 48, or 8 inches for each foot of run. This, then, gives us the figures for applying our steel square to the 2 by 4 rafter. First lay off the plumb cut by placing the square on the 2 by 4 so the 8-inch and 12-inch division are in line with the upper edge of the rafter, as shown in "A" in the first sketch. Then make a fine mark at the 12-inch division and transfer the square so the 8-inch division coincides with the first 12-inch mark made on the rafter. Make as many

transfers as there are feet in the run, and the last 12-inch pencil mark will be directly above the outer edge of the studding. Now slide the square farther down, keeping the 8 and 12-inch divisions on the upper edge of the rafter, and mark off the seat cut to the desired depth.

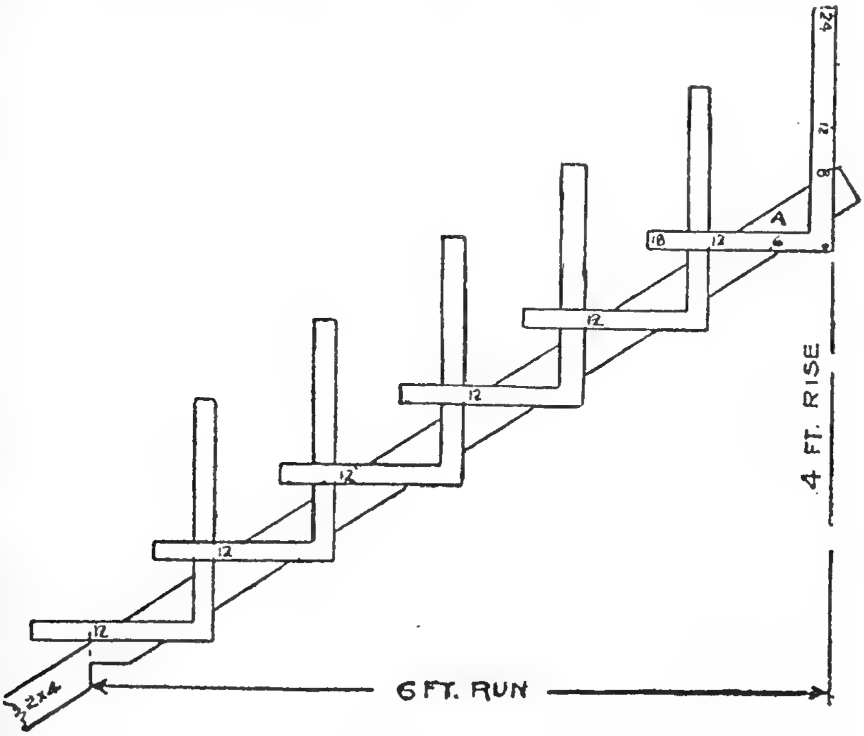


PLATE 278.

The transfers and marks must be very carefully made to get accurate results. Also choose 2 by 4 that is absolutely straight. After carefully sawing out one rafter, it can be used as a pattern for the rest.—"Farm and Ranch."

The Australian Nut—Method of Roasting.

The Australian nut is becoming deservedly popular, but with some types there is a difficulty in breaking the tough shell, and an even greater demand may be anticipated for this nut when the shelled kernels are more widely marketed, either fresh or roasted.

When roasting, the nuts must be fully matured if the best results are to be obtained. The kernels containing the highest oil content give a better-flavoured product than those with a low percentage of oil. The latter are liable to darken or char during the roasting process.

To determine which nuts are suitable for roasting, the specific gravity of the kernels is roughly tested. The dividing line is around a specific gravity of 1; kernels with a specific gravity of less than this have a higher oil content, and contain less sugar. The fresh flavour of the two types is quite distinct. Generally speaking, the smooth-shelled nut has more oil and less sugar than the rough-shelled nut, and it is a more desirable type to grow.

Some trees produce nuts that have bitter kernels. Care should be taken that these are not included in the nuts offered for sale.

The kernels are air-dried in the shell before the nuts are cracked; they are then dried at a temperature of 175 degrees Fahr. for four hours in an oven through which a fair draught of air is continually passing. The kernels are then roasted for forty-five minutes at a temperature of 270 degrees Fahr., and allowed to cool, and gum arabic (10 grammes to 100 c.c. water) is applied. Salt is sprinkled over the kernels, which are then finally dried for a short while at 150 degrees Fahr.

To cook the kernels in vegetable oils, first dry as described, and then cook in the vegetable oil for fifteen minutes at 280 degrees Fahr.—A. and P. Notes, N.S.W. Department of Agriculture.

Cementing a Worn Tank.

A lasting method of repairing corroded iron tanks is to coat them with cement "compo." The method described will be found efficient, and the resultant tank will be strong, rust-proof, and indestructable. The tank must be thoroughly cleaned of all mud and foreign matter both inside and out. Holes are punched in the walls.

PLATE 279.

These holes should be approximately half an inch in diameter and spaced about 12 inches apart. Small mesh wire netting of half-inch mesh and 22-gauge is then lapped around the tank both inside and outside, the layer for the bottom overlapping on the walls about 6 inches, both layers being laced through the holes, using fine tie wire. In the case of a large tank, the bottom must be plastered first, overlapping the walls about 6 inches, and allowing to harden so as to provide a foothold when plastering the walls. Before plastering, the tank is treated with a neat cement wash, thrown on to the surface by means of a brush. This is to

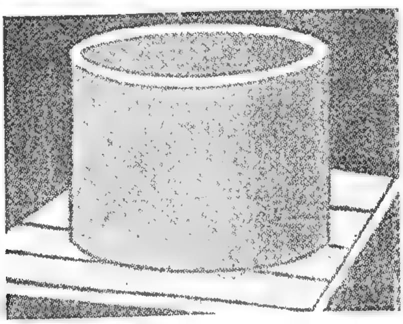


PLATE 280.—CEMENTED TANK.

provide a bond between the tank and the plaster. Now mix a mortar of one part cement to two parts fine clean sand with only enough water to form a stiff but workable mix. Apply in thickenesses of ½-in. When almost hard, score surface to provide bond for next coat. Allow each coat to harden, then damp cure for two days. Thoroughly moisten each coat before application of succeeding coat. Cure finished work for seven days before using. The finished tank combines a neat appearance with strength and utility.

A tank of 6 feet in diameter, 6 feet deep, having a capacity of 1,060 gallons before treatment, would have its capacity reduced to 970 gallons after repair to concrete walls and bottom 2 inches in thickness. Quantities of material required would be 11 cubic feet of cement and 22 cubic feet of sand. A paper bag of cement contains 1⅓ cubic feet. A tank 12 feet in diameter, 6 feet deep, having an original capacity of 4,230 gallons, would require a 3-inch cement wall and bottom. Its capacity when repaired would be 3,880 gallons. Materials required: 39 cubic feet of cement and 79 cubic feet of sand.

Feeding for Butter-fat Production—No Grass or Legume "Best."

Each component of the mixed pasture which is desirable for the feeding of dairy cows has its value, and it would be invidious to speak of any grass or legume as "best," points out an article in the "Agricultural Gazette" of New South Wales.

In indicating the impossibility of accurately compiling such information, attention is called to the fact that the percentage of butter-fat in the milk of any animal depends to a far greater degree on the inherent ability of the particular breed or strain to give high-quality milk than on the quality of feed given. Any increase in butter-fat production would be due to increased quantity of milk produced, and not to improved quality.

Moreover, the effect of any particular plant on the nutritive ratio and nutritive value of other plants with which it is likely to be found in association must also be borne in mind. Whereas, for example, a roughage and a concentrate in certain proportions may form an excellent milk-producing diet, yet it cannot be stated that one or the other has superior value, since each would prove unsatisfactory if fed alone. Thus it is only possible to indicate in a general way which plants possess high nutritional values and to indicate in what proportions admixture is desirable.

Referring to the grasses usually recommended for parts of the North Coast (N.S.W.), namely, paspalum, perennial rye grass, cocksfoot, *Phalaris tuberosa*, tall oat, prairie and Italian rye grass, it was pointed out that at similar stages of growth all were practically of equal feeding value.

Paspalum as a sole item of diet is lacking in both protein and phosphorus, but it can nevertheless be an excellent pasture plant when growing in conjunction with white clover, red clover, subterranean clover, trefoils, or other luguminous plants rich in those constituents lacking in paspalum. Such grasses as the spear, wire, Parramatta, and carpet are quite definitely undesirable, due to high fibre content and low digestibility and protein content.

In regard to the legumes, the best plan to adopt is to utilise those which succeed best in the particular area under consideration, since all legumes are high in protein, lime, and phosphorus content. Presuming that good methods of pasture management are used, a suitable proportion is approximately 65 per cent. of high-quality grasses and 35 per cent. of legumes.

Management is such an important factor controlling pasture value that it must be as carefully considered as the species present. In the case of all plants used for grazing purposes, it has been found both by analytical methods and by field experience that after the plant has passed a certain stage of growth its value as feed declines rapidly, till at maturity it is far below the earlier level. For example, at Berry Experiment Farm (N.S.W.) cuts taken when the young pasturage was 4 inches high and cuts of mature (flowering) pasture of the same botanical composition gave chemical analyses as follows:—

—	Immature Pasturage.	Mature Pasturage.	Percentage increase of immature over mature Pasturage.
	Per cent.	Per cent.	Per cent.
Protein	10·481	8·044	30·3
Lime (CaO)	·428	·337	27·0
Phosphoric Acid (P_2O_5) ..	·474	·446	6·3

These figures are from a good pasture. Where undesirable species are present the effect is much more marked, due to the high fibre content of the mature plants.

Hence, whereas a pasture when 4 inches high may be quite ideal in its feeding qualities, precisely the same botanical mixture is likely to be too low in protein content when allowed to reach maturity. The inferior value of tall, rank paspalum compared with a short, quickly-growing cover of the same grass is well known.

Thus, to increase milk yield and with it the butter-fat yield, it is vital that the farmer adopt such a system of management as to keep his stock continuously on young pasturage. This can be achieved satisfactorily only by subdivision of the paddocks to such a size as to permit a system of rotational grazing with brief but heavy stocking of the paddocks successively.

The Prayer of the Horse.

"To thee, my master, I offer my prayer.

"Feed me, water, and care for me, and when the day's work is done provide me with a shelter and a stall wide enough for me to lie down. Talk to me. Your voice often means as much to me as the reins.

"Do not whip me when going uphill. Don't beat or kick me when I do not understand what you mean, but give me a chance to understand you. Watch me, and if I fail to do your bidding see if something is not wrong with my harness or feet.

"Examine my teeth when I do not eat. I may have an ulcerated tooth, and that, you know, is very painful. Do not tie my head in an unnatural position, or take away my best defence against flies and mosquitoes by cutting off my tail.

"And finally, oh my master, when my useful strength is gone, do not turn me out to starve or sell me to some cruel owner to be worked and starved to death; but do thou, my master, end my life in the kindest way. You may not consider me irreverent if I ask this in the name of Him who was born in a stable. (Translated from the Arabic.)

A Dozen "Don'ts" for Horse Drivers.

Extract from the Annual Report of the Queensland Society for the Prevention of Cruelty:—

Don't fail to rug your horse when he stands in the cold.

Don't forget that ills often result from exposure and chill which follows suddenly checked sweating.

Don't fail to keep your horse well shod.

Don't work a lame horse or you may make a temporary injury a permanent one.

Don't let any alleged blacksmith lame your horse. Do you cut your own feet down to fit your boots? Well, don't forget that your horse's shoes should be shaped to fit his feet, and not his feet shaped to fit his shoes.

Don't load your horse too heavily, especially when the streets and roads are wet and slippery.

Don't force him to back a heavy load over a slippery road or up-hill.

Don't fail to grease your waggon axles. There is a heap of humanity in wagon grease.

Don't put badly-fitting harness on your horse.

Don't forget that there is more profit in coaxing a horse than in kicking him.

Don't thrash your horse if he jibs. Lift his collar and wipe it and his shoulder, and let the air at them; then tie your whip thong round his foreleg just below the knee and pull his leg forward to start him. Try it.

Don't illtreat your horse, or you may have to answer to the court for it.

A New Hen—The Cambar.

Queensland poultry raisers will be interested in this note on the evolution of new breed—the Cambar—by a writer in the "Spectator" (London), for 13th July, 1934. Few successes of greater interest or more prospect of practical value have been won in the field of agricultural biology than the making of the new Cambridge hen. Mr. Punnet and his fellow Mendelians at Cambridge have put into their new breed exactly the virtues they desired. and such precise control is comparable with the achievements of the plant breeders. The first Cambar, as the new breed was christened, was "invented" for the sake of possessing a pure-bred hen whose chicks would declare their sex at birth. It is, of course, an immense advantage to the industry to be able to distinguish day-old chicks, for the reason that they travel safely and well only during the first two days of their life; and the trade in day-old chicks becomes very large. This was the first success. Since then a silver as well as a gold Cambar has come into being; and by the use of the Canadian Barred Plymouth Rock (supplied by the University of British Columbia to Cambridge University) the new breed is becoming prolific and a great layer of large coloured eggs without letting go the virtue of "sex-linked" chicks. I saw six of them of one hatching last week; and the babes are as distinct in uniform as their parents. No one could fail to distinguish hen and cock. The birds mark an epoch in scientific breeding applied to practical purposes.

Queensland Co-operative Bacon Association.

At the annual meeting of the Queensland Co-operative Bacon Association, Ltd., Mr. James A. Heading, chairman of directors, presided, and, in moving the adoption of the report and balance-sheet, he said the operations had been conducted at a profit. The average price paid for pigs for the whole year was over one half-penny per lb. better than last year, and higher than since 1930. A total of 53,350 pigs had been received, an increase of 11,121. The numbers, however, were not nearly up to the requirements or capacity. The question of greatest moment at present was the need of greatly increased supplies.

Sales for the year were £178,576, an increase of £38,860. All branches of the selling organisation contributed to this increase. The quality of "Atlas" products had been consistently maintained, and this had been very helpful in increasing the demand.

The Sydney branch had another successful year, sales there being £51,071. The association now had 5,025 shareholders.

Negotiations for the amalgamation of the two co-operative bacon associations were still in progress, but it appeared most unlikely that they could be brought to fruition. In connection with the amalgamation proposals an independent valuation of the assets of the association had been made, and Messrs. Robinson and Jolly had certified that the assets were considerably in excess of book values. The election of directors resulted:—Burnett and Mary Valley, Mr. J. A. Heading (returned unopposed); West Moreton, Mr. G. Setch (returned unopposed); South Burnett and Brisbane Valley, Mr. G. E. J. Chaseling, 166; Mr. J. T. Mulcahy, 140. Mr. W. H. F. Buchanan was re-elected auditor. Chairman's allowance and the directors' and auditor's fees were fixed at the same as last year. Shareholders present expressed keen appreciation of the progress of the association.

Composition of Milk—Causes of Variation.

The average composition of pure cow's milk under New South Wales conditions is 86.88 per cent. water, 4.0 per cent. fat, 3.32 per cent. casein, .39 per cent. albumen, 4.67 per cent. milk sugar, and .74 per cent. ash, but variation may be caused by any of the following causes or any combination of them:—

1. The cow—its breed, its individuality, health, and condition.
2. The period of lactation.
3. Time of milking—morning or evening.
4. The part of the milk tested (whether first part or the strippings).
5. The food and water consumed by the cow.

Fat is a normal constituent of cow's milk, usually ranging on a percentage basis from 2.8 to 6.5 per cent., but varying (*a*) with the breed, and (*b*) with individuals of the same breed. The following table shows the range and the average of the butter-fat content of the milk of New South Wales cows of the different breeds:—

Breed.	Range.	Average.
	per cent.	per cent.
Australian Illawarra Shorthorn	2·8 to 5	4·0
Jersey .. .. Guernsey	4·2 to 6·5	5·0
Ayrshire .. .. Friesian	2·8 to 4·6	3·8

Several factors influence the variation in the fat content of milk given by the same cow. The more important of these are temperament, climate, physical condition, breed, and feed.

Temperament.—The cow is a very nervous animal, and harsh treatment easily upsets her. Often the better the breeding and the greater the production the more highly strung she is. Beating, scolding, and using dogs are some of the practices that should not be tolerated in a milking yard. Not only will the quantity of milk given decrease considerably from such treatment, but the fat content will likewise diminish. It has been noted frequently that a test has dropped 1 to 1.5 per cent., and the milk weight 30 to 50 per cent.

Climate.—Food given a cow serves the double purpose of providing (*a*) heat and nourishment of the body, and (*b*) milk. If the animal is well sheltered and rugged during very cold weather, a greater portion of the food eaten is used for milk production. Official records repeatedly show that during or immediately subsequent to cold, windy, wet weather the yields of cows not properly cared for in the way of shelter and warmth have been appreciably lowered.

Physical Condition.—Cows, like all other animals, have their periods of sickness, or they may be merely what we term "off colour." Digestion may be faulty or there may be some slight physical ailment, or something more serious, like abortion. The more frequent cause of variation in milk weight and fat content is from being in season. At such a time milk production is never normal.

Breeding.—The fat content of milk is to a great extent a question of inheritance. Different breeds are noted for high, medium, or lower percentage of fat. Jerseys, for instance, have long been noted for a high percentage. Friesians had in the past a name for great volume, but with a low fat content. Recently, however, this breed is proving by records that the average fat percentage has been and is being increased. The Australian Illawarra Shorthorns are proving the same thing. Thus it is evident that the capacity to give a milk rich in fat can be bred into any breed of cows by careful selection in a comparatively short period of time. This would not be done in one or two generations, but experience shows that a gradual improvement can be made.

Feeding.—A cow inherits fat-producing capacity (*a*) on account of her breed, and (*b*) individually, as a result of breeding. This might be termed her maximum capacity. She can, by careful treatment and proper feeding, and if everything is in her favour, reach this maximum, but not exceed it. Even to reach it too great a strain might be necessary on her constitution for too long a time, to her permanent injury.

The first essential to giving a cow a chance to show what she can do in the way of production is to have had her sire in good health and condition when serving her dam, and more important still is that the dam should have been in good condition at time of calving. The heifer when born needs the best of attention as regards feeding and housing during the first six months of her life, especially during the first two. If a cow has been well born and well reared her records for production in after life depend to a great extent on feeding.

She should not be starved during the three or four months preceding freshening, and after calving she should be well and regularly fed. Both under-feeding and over-feeding are undesirable; too rich a ration (one containing too great a proportion of concentrates) and a ration of grainless wheat straw are both to be avoided. The digestive organs of a cow should not be out of order if she is to give good results. The cow's test will vary according to her feeding, but is limited by her inherited maximum.

During droughts, when stock are nore than half-starved, the fat content of their milk is lowered. This has been demonstrated by the official records obtained from both Government and private herds. Again, during the spring season, when the pastures are soft and young, while the quantity of milk given increases, the fat percentage is lowered.—A. and P. Notes, N.S.W. Dept. Agric.

Buying Better Boars—Assistance to Settlers.

The Better Boar Subsidy Refund Scheme in operation over the period August, 1933, to 30th July, 1934, attracted considerable attention throughout Queensland and resulted in a wide distribution of pedigreed boars in the Large and Middle White breeds, and in increased interest in the development of more extensive outlets for Queensland pork in the markets of the United Kingdom.

Boars were distributed to numerous centres in the Western, far Northern, and Central areas; to the South, Central, and Upper Burnett; North and South Coast and branch lines. This scheme terminated on 30th June, 1934, and has been replaced by a scheme fostered by the Rural Assistance Board of the Agricultural Bank. Under this scheme the Board, acting in co-operation with the Agricultural Bank and Department of Agriculture and Stock, advances on loan 50 per cent. of the landed cost of boars, four months to two years of age, in the following breeds:—Large White, Middle White, Tamworth, and Berkshire.

Forms of application are now available and may be obtained by writing to the Department of Agriculture and Stock, Brisbane, or to the Agricultural Bank. The loan is repayable on easy terms over a period of two years, subject to satisfactory arrangements being completed on receipt of the application form properly completed and accompanied by a fee of 5s. payable to the Rural Assistance Board, Agricultural Bank, Brisbane.

Points for the Pig Raiser.

A question that often crops up in the judging of pork and bacon pigs at agricultural shows is as to whether the sow will make up into better bacon than the barrow. The answer to such a question takes into consideration two phases. Sow pigs, particularly in warm climates, come in season very early and one often notices sows awaiting slaughter that show distinct evidence of the oestral period (or of being on heat or in season). If slaughtered while in the feverish condition that accompanies the oestral period the meat will not set well nor will it be as mellow as is desirable in the finished form.

On the other hand sow pigs produce a larger proportion of first grade lean meat than barrows, for sows are lighter in back fat and are thicker in the streak of lean meat running along the sides than is the case with males; on the other hand there is less risk with barrow pigs, although it must be remembered that improper castration often results in the formation of deep-seated abscesses in the area of the scrotal sac and many a good pen of barrow baconers has suffered at the hands of the judge who is discriminating and takes a special care to examine that portion of the body before giving his decision. Perhaps after all, sow pigs do make the best bacon, but on the average so much depends on breeding, type, feeding, and handling that the matter of sex is virtually an unimportant one, and further the farmer has no control over the sex of his pigs, so must make the best use possible of both boars and sows.

Is Salt a Tonic or an Appetiser.—Visiting a well-known Brisbane stud piggery recently, it was noticed that the man in charge of the pigs kept a bag of coarse salt (usually known as pickling salt) close to the feed boiler. When asked if he used salt in the food he replied that he regularly added a handful of salt to the food when preparing same for cooking, for he had noted over a series of years that the pigs always made better growth and had better appetites when a little salt was added to their food.

The quantities used would, of course, be important, and should not exceed, say, one half teaspoonful per pig per day; salt has a good food value, and is a necessity in all rations, but care must be taken not to force the pigs to consume too much, and the water in which corned beef or ham has been boiled should on no account be used unless distributed over a large quantity of food, for salt can become a poison just as it is a necessity. Charcoal, wood ashes, and bone meal are further additions, so also is a cup full of lime water added to the pig's food occasionally.

The careful farmer watches all these points and sees to it that his pigs do not suffer as a result of a deficiency in mineral matters.—E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

Controlled Grazing of Pastures.

Conditions vary so much in different districts, and even on the same property, that no hard-and-fast rules can be laid down with regard to the subdivision of paddocks, observes a departmental pamphlet on pasture management. The aim should be to provide sufficient paddocks to control the grazing completely, so that an even growth can be maintained in each. With controlled stocking the pastures can be fed off when at their maximum feeding value, i.e., when they are providing short, succulent growth high in protein content, and there is no waste such as is associated with more mature but less palatable and less nutritious growth.

Paddocks that are too large result in stock having to travel long distances for food and water, which is particularly undesirable for fattening or milking stock, as much of the food consumed is then used to supply energy for unnecessary walking. This point is of importance to those contemplating fat-lamb raising or the production of early-maturing beef. Large paddocks are also responsible for a certain amount of erosion, as the animals in their search for food tend to traverse definite tracks, which become bare of grasses. In hilly country these bare tracks form channels along which water flows, finally resulting in erosion.

The expenditure entailed in laying down large areas of sown pastures on well-prepared land is considerable, and although returns amply justify the outlay, some pastoralists have not the capital available for this work on a large scale. By choosing the most suitable soils and situations, however, it is remarkable what excellent results can be obtained from small areas of sown pastures when used in conjunction with larger areas of natural pastures, and graziers with limited capital should proceed on these lines.

Creek-frontage country properly subdivided, with the land well prepared and sown down to mixtures of grasses and clovers or lucerne, is particularly suitable for this purpose. These areas should be subdivided and fenced so that stocking can be regulated and the stock given access both to the sown and natural pastures; it should always be possible to close up the sown pasture when necessary. It may be thought that where stock have ready access to sown pastures they will concentrate on these and neglect the natural pastures. In practice, however, this is seldom the case, as a certain amount of rough feed is essential and the stock will obtain this from the natural grasses.

By adopting this system stock can be left in the paddocks for longer periods than would be the case with small paddocks of sown pastures, and then can be kept off the sown pastures in the event of over-grazing on these areas. It may also be desirable to save the sown pasture at times in order to ensure a supply of winter feed or succulent pasture for lambing ewes, sick animals, or for "topping off." When working on these lines, the movements of stock can be regulated to some extent by top-dressing. It is not sound practice, for example, to top-dress the small area of improved pasture and leave the natural pasture unmanured, as this tends to encourage grazing on the improved section. By top-dressing the natural pasture, the palatability and nutritive value are increased and the tendency is for the stock to utilise these pastures in conjunction with the sown pasture.

A system similar to the above is also desirable with grazing lucerne, as a balanced ration is provided, and the stock can be quickly moved on to the grass in the event of hoven, although liability to this trouble is decreased by the practice.

When arranging the disposition of watering-places, stock licks, &c., consideration should be paid to the well-being of the pastures, and these so placed as to avoid concentration of grazing on small patches as far as possible.

Top-dressing, particularly on herbage country, frequently results in a pasture composed almost entirely of clovers for a period, and where this occurs stock should have access to grass paddocks where the percentage of clover is small.—A. and P. Notes, N.S.W. Dept. of Agri.

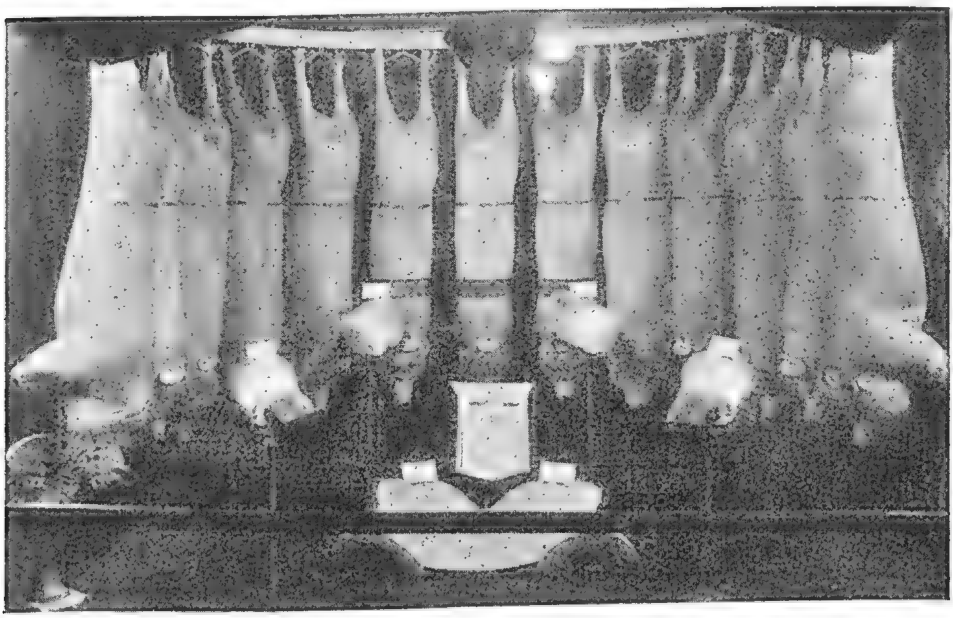
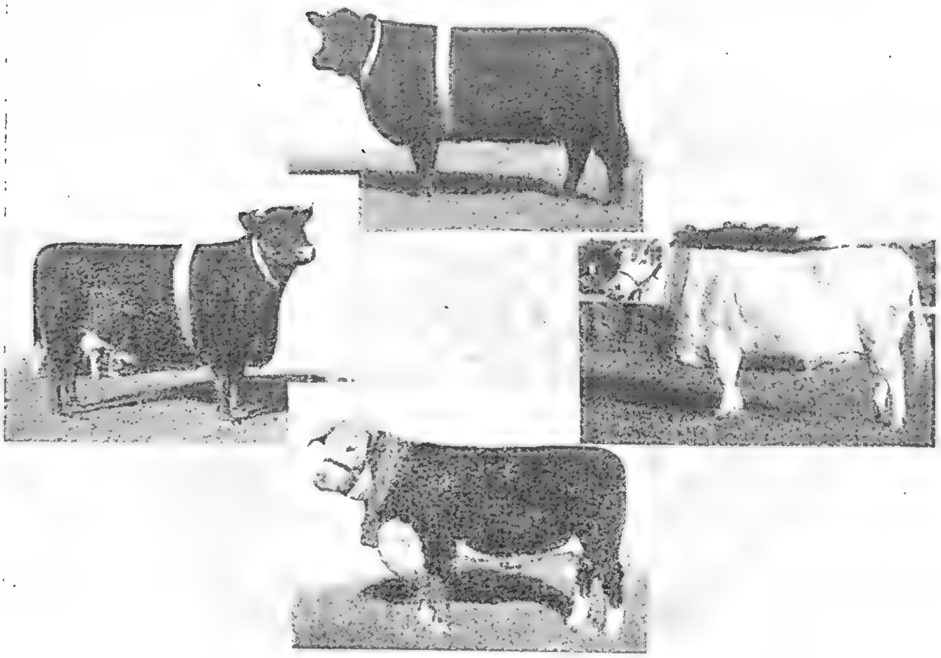


PLATE 281.—TYPES OF SOUTHERN QUEENSLAND PORKERS.

[Block by courtesy of the Queensland Meat Industry Board.



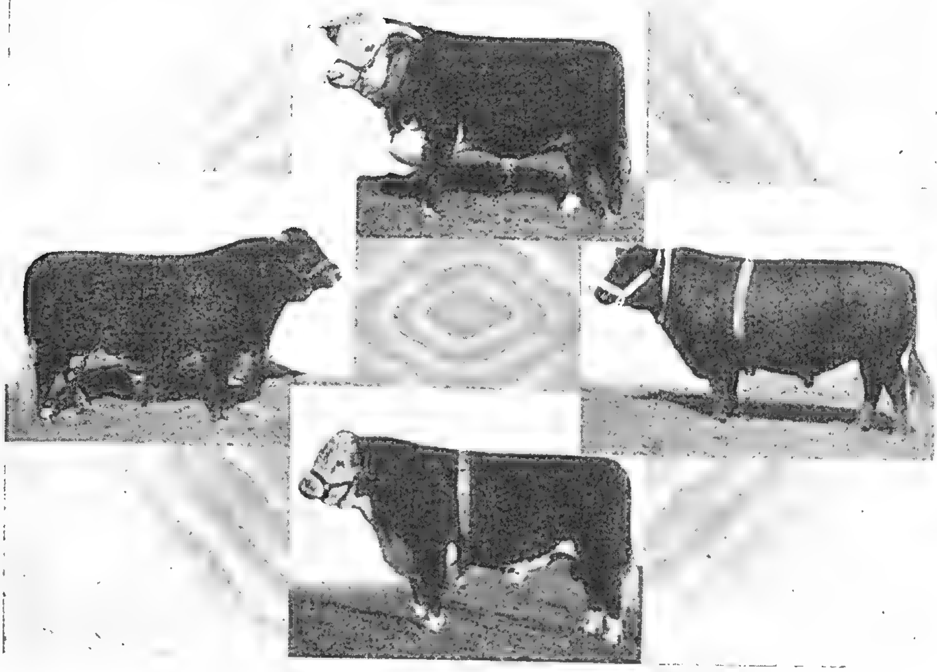


PLATE 282.—BEEF CHAMPIONS, BRISBANE SHOW, 1934.

[Block by courtesy of the Queensland Meat Industry Board.

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

ECONOMICAL DIETS.

In November, 1933, there was published a valuable report of a special committee appointed by the Council of the British Medical Association "to determine the minimum weekly expenditure on foodstuffs, which must be incurred by families of various size, if health and working capacity are to be maintained, and to construct specimen diets." Food prices in Queensland are very different from those in Great Britain, and it would be impossible for us to accept the diets proposed without modification; but by adopting the data given in this report, and by following the same methods of calculation, it is possible to construct sample diets, which should be useful to those Queensland mothers who are compelled to exercise great economy, and should enable them to spend their small weekly allowance in such a way that the nutrition of their families should not suffer.

Requirements of the Diet.

It is obvious that a man weighing 9 stone engaged in a sedentary occupation can maintain his health and working capacity on less food than is necessary for a man weighing 13 stone, who is doing daily hard muscular work. We are compelled to strike an average, and allowance will have to be made for individuals who depart largely from that average. The diets given are calculated for an average man not engaged in strenuous manual labour. It must provide sufficient food to maintain health and weight, and food of suitable kind. That is, it must be of adequate energy value, must contain an adequate quantity of proteins (body-building foods), carbo-hydrates (starches and sugars), and fats. It must also contain a liberal supply of vitamins, a most important point, in which many common diets fail lamentably. Finally, it must provide sufficient variety, so that there is no deadly monotony in the diet.

Methods of Calculation.

The energy value of a diet is calculated in units which are called calories. The official scale in Great Britain has been 3,000 calories per man daily. For several good reasons the committee has adopted a higher scale of 3,400 calories. The requirements in proteins are placed at a weight of 100 grams, of which one-half should be animal proteins. Those of fats also at about 100 grams, of carbo-hydrates 500 grams. The contents of proteins, fats, and carbo-hydrates in all common foods have been ascertained by analysis; the vitamins cannot be determined quantitatively, but in the diets constructed they are abundantly present.

Sample Weekly Diets.

—	Man, wife, one child between 3 and 6.		Man, wife, three children; one between 6 and 8, one between 8 and 12, one between 12 and 14.	
	Quantity.	Price.	Quantity,	Price.
		s. d.		s. d.
Beef and mutton (cheaper cuts)	4½ lb.	1 1½	10 lb.	2 6
Liver, heart, kidneys, &c.	2 lb.	0 6	3 lb.	0 9
Eggs	..	..	4	0 4
Cheese	½ lb.	0 6	½ lb.	0 6
Milk	10½ pints	2 7½	14 pints	3 6
Butter	1 lb.	1 4	1½ lb.	2 0
Dripping	1 lb.	0 4	1½ lb.	0 6
Flour	4 lb.	0 6	6 lb.	0 9
Cooking Bran	..	¼	..	0 0¼
Bread	13½ lb.	3 4½	27 lb.	6 9
Sugar	3 lb.	1 0	5 lb.	1 8
Golden Syrup	..	..	1 lb.	0 3¼
Jam	1 lb.	0 4	1 lb.	0 4
Potatoes	8 lb.	0 9	14½ lb.	1 4
Dried peas or beans	½ lb.	0 2	1 lb.	0 4
Oatmeal	1 lb.	0 3	2 lb.	0 6
Wheatmeal	1 lb.	0 3	2 lb.	0 6
Rice	½ lb.	0 1½	..	..
Pearl Barley	..	..	½ lb.	0 1½
Tea	½ lb.	1 0½	½ lb.	1 0½
Salt, carbonate soda and cream of tartar ..	..	0 1½	..	0 2½
Fresh fruit and vegetables	..	2 0	..	3 0
Total	..	16 4¼	..	29 11¼

Man Values.

If the food requirements of a man be taken as one, that of other members of the family are calculated on the following scale:—

Ages.	Man-value.
Adult, man	1.00
Adult, woman	0.83
Child, 1 to 2 years	0.30
„ 2 to 3 years	0.40
„ 3 to 6 years	0.50
„ 6 to 8 years	0.60
„ 8 to 10 years	0.70
„ 10 to 12 years	0.80
„ 12 to 14 years	0.90
Persons over 65 years	0.75

To calculate diets for families of all sizes and ages is therefore possible. We shall content ourselves with two families only.

The first consists of man, wife, and one child between three and six years of age. By reference to the following table its man-value is found to be 2·35. The second family consists of man, wife, and three children, one between six and eight years, one between ten and twelve, one between twelve and fourteen. Its man-value is 4·13. We shall omit the calculations of the calories, proteins, carbo-hydrates, and fats of each article in the two diets, and merely give the totals.

In the first diet the calories are 3,454, the proteins 100·5 grams, of which 47·1 are animal proteins, the fats 106·1, the carbo-hydrates 493·0 per man per day. In the second diet the calories are 34·9, proteins 103·2, animal proteins 47·2, fats 108·4, carbo-hydrates 498·2. These calculations are not so precise as they seem, as some foods vary in composition. They are given to satisfy those who understand these matters. For most of our readers only the quantities and prices are of importance.

Remarks.

These diets are sufficiently varied and contain everything necessary for wholesome nutrition. Undoubtedly they might be made more varied and pleasing by spending a few more shillings, but as they stand they are better food than is consumed by many who spend twice as much. There is a prejudice against liver, but it is a more valuable food than beef-steak, and many like it disguised under the name "lamb's fry." One pint of milk per day is provided for the child under six, half a pint for the older children, one quarter pint for the adults. It would be better to have two or three pounds of butter, but for economy dripping has been substituted for half the butter, not margarine, which costs three times as much and is not a trustworthy food. Cooking bran is provided to supply a necessary vitamin, and its cost is negligible. Eggs should be bought only when cheap; when they are dear another half pound of cheese may be substituted. A fixed sum is provided for the purchase of fresh fruit and vegetables, to be expended at the discretion of the housewife. She is specially advised to buy tomatoes when they are cheap. Tea has no food value, but has become a necessity to many adults. Children do not need it and are better without it. At most they should have a mere pretence.

The prices are low (not always the lowest) Brisbane prices, but the prices of many things vary. We cannot give the prices elsewhere; our readers must find out for themselves.

IN THE FARM KITCHEN.

THE DIETETIC VALUE OF THE POTATO.

Subjoined are extracts from the address of Mr. A. J. PINN, Special Agricultural Instructor, at a recent New South Wales Agricultural Bureau Conference:—

The potato has always been regarded as an important vegetable in the diet of Australians. Its use in the diet has, in the past, not been dictated by any study of the dietetic value, but simply on account of its appeal to the palate, its relative cheapness as an article of food, its ease of preparation, or by habit acquired in the early home-training.

Owing to the fact that the *per capita* consumption of potatoes is decreasing, and in the light of recent dietetic investigations, it is necessary from a community health point of view that the general public be acquainted with facts relative to the health-giving tuber. With so many "Eat More" campaigns, and the advertised claims of various manufactured foods, it is also necessary that the consumer give serious consideration, not to bold statements made in advertisements, but to the true facts founded on scientific investigations. It is quite obvious that most persons cannot eat more of all the various foods advertised, so must therefore choose those which are at a cost within the limits of the purse, and at the same time provide the necessary requirements for the sustenance and healthy functioning of the body.

In order to obtain the full food value of the potato, it is essential that the housewife should know that the methods of cooking now commonly practised are wasteful. In the first place it must be realised that in the peeling of tubers much

of the nutrient value of the potato is lost, and for that reason it is suggested that the cooking in the skin should become more general. Baking the tubers is less wasteful of food values than boiling.

If it is desired to follow the old practice of first peeling the potatoes before boiling, it is desirable that the potatoes be not soaked in water, awaiting time to commence cooking. This practice allows of loss of food value, as also does the placing of the potatoes in cold water to bring them to the boil. If the peeled tubers are placed direct into boiling water, much less loss of food value results. Research by the Chemical Division of the Minnesota Agricultural Experiment Station has indicated that the loss of albumenous compounds was as follows:—

	Percentage loss.
(*a*) Peeled potatoes started in cold water	80
(*b*) Peeled potatoes started in hot water	10
(*c*) Potatoes, *not* peeled, started in cold water	50
(*d*) Potatoes, *not* peeled, started in hot water	2

The following extracts from the writings of Dr. J. H. Kellogg, Superintendent of the Battle Creek Sanatarium, Michigan, U.S.A., should be of interest, particularly in respect to the value of the potato as a health food.

The potato is truly a most remarkable product. It contains within its aseptic covering a rich store of one of the most easily digestible of all forms of starch. The observations of Mosse, Van Noorden and others have shown most conclusively that the starch of the potato is more easily digested and appropriated by the body than the starches of wheat, corn, and most other cereals. In laboratory tests made by the writer it was found that potato starch digested in less than one-sixth of the time of cereal starches.

''The potato is not only an easily digestible foodstuff but possesses much higher nutritive value than is generally supposed. According to Gautier, about one-fourth of the weight of the potato is food substance, consisting chiefly (nine-elevenths) of starch. Of the remainder, three-fifths are protein (the tissue-building element), and two-fifths alkaline salts in combination with citric and malic acids (acids of the lemon and the apple).

''The belief is quite general that the potato especially promotes fat-making, and hence that its use must be avoided by persons who have a tendency to obesity. This is also an error. All foods tend to produce obesity when taken in excessive quantity—that is, more than the individual needs to maintain his nutrition on equilibrium. No foods produce excess of fat when limited in quantity to actual daily bodily needs.

''As a matter of fact, the potato is deficient in fats, of which it contains almost none, because of the fact that it is not, like so many of our vegetable foods, a seed, but a curiously modified and enormously fleshy tuber. This deficiency in fat must always be remembered in the use of the potato, and the lack must be made up by the addition of cream, butter, or some other foodstuff rich in fat.

''The potato is of immense service as a food remedy in the treatment of a large number of diseases. It is especially valuable in cases of chronic intestinal auto-intoxication or 'biliousness.' It affords bulk for the intestine to act upon, and so antagonises constipation. The large proportion of starch and other carbohydrates encourages the growth of friendly bacteria in the intestine, thus preventing putrefaction. For the same reason the free use of potatoes combats rheumatism and gout, which are results of chronic intestinal poisoning.

''The potato is valuable in the treatment of anæmia, because it contains the growth in the intestine of the germs which produce blood-destroying poisons. The death rate from diabetes, according to the mortality statistics of the United States Census Bureau, has increased nearly 50 per cent. in ten years. The freer use of potatoes as an article of diet and the lessened consumption of meat would perhaps do more than any other one thing to suppress the alarming increase of this fatal malady.

''Arteriosclerosis, or hardening of the arteries, a disease which causes apoplexy, and is associated with Bright's disease and various forms of heart diseases, besides being the cause of premature old age, is most often directly the result of chronic poisoning, the source of which is the putrefaction of undigested remnants of animal substances which have been eaten, which undergo decay with the absorption of poisonous products. The free use of the potato as an article of diet in place of the excessive consumption of meat and fish, a practice widely prevalent, would unquestionably check the alarming rapid development of this disease, which, according

to the United States mortality reports, has increased 400 per cent. in the last ten years.

"The potato, butter-milk, and oatmeal diet of the Irish has developed one of the most sturdy and enduring races of men to be found anywhere. The proportion of centenarians in Ireland is more than ten times as great as in England. There can be no doubt that the free use of potatoes by the Irish is in a large measure responsible for the remarkable longevity of this nation.

"The potato more than any other single article of food is capable of rendering a notable service in conserving and prolonging human life. It is highly important that the public should be informed respecting the supreme dietetic value of the potato and instructed in its use. Every adult should eat at least 1 lb. of potatoes daily. It is to be remembered that the tuber is three-fourths water. Infants of six months may be given potato puree with benefit, especially as a protection against acidosis, which often manifests itself in children as cyclic vomiting.

"More potatoes and more milk, more green vegetables—spinach, lettuce and the like—with bran and fresh fruits to aid elimination; these are the nation's greatest dietetic needs."

RECIPES.

Baked Apple Dumplings.

Materials.—Four apples, 4 cloves, 4 teaspoonfuls sugar, 1 dessertspoonful butter, icing sugar, $\frac{1}{4}$ cup of water. For Pastry—4 oz. flour, 2 oz. lard or dripping, $\frac{1}{4}$ teaspoonful baking powder, pinch of salt, $\frac{1}{4}$ cup of water.

Utensils.—Knife, corer, board, baking tin, brush.

Method.—

1. Peel and remove cores from apples.
2. Put into centre of each apple, sugar, clove, and butter.
3. Make short pastry, cut it into four parts, knead each part into a circle.
4. Put an apple on each circle; work the circle up to cover the apple.
5. Put covered apples on a baking tin; brush over with sugar and water.
6. Bake in a moderate oven for 30 minutes or until apples are tender.
7. Sprinkle with icing sugar; serve with custard.

Chocolate Pudding.

Materials.—One cup bread crumbs, 1 egg, 1 cup milk; 1 dessertspoonful butter, 1 tablespoonful chopped nuts, 1 tablespoonful sugar, 1 dessertspoonful of cocoa.

Utensils.—Pie dish, whisk, spoon, saucepan, basin, cup.

Method.—

1. Attend to the oven.
2. Place milk on to boil; put bread into a basin.
3. Pour milk over bread and allow to stand covered for ten minutes.
4. Add cocoa or chocolate, sugar, nuts, butter, and beaten yolks of eggs.
5. Beat all well together.
6. Place in a greased pie dish and bake in moderate oven for three-quarters of an hour.
7. Decorate with well-beaten white of egg.
8. Return to oven and slightly brown.
9. If steamed, add the well-beaten white of eggs, fold in lightly, and place in greased basin and steam for one and a-quarter hours.
10. Serve with boiled custard or chocolate sauce.

Chocolate Sauce.

Materials.—One dessertspoonful arrowroot, 1 dessertspoonful cocoa, 1 tablespoonful sugar, $1\frac{1}{2}$ cups boiling water.

Utensils.—Wooden spoon, basin.

Method.—

1. Blend arrowroot, sugar, and chocolate together in a basin.
2. Pour over sufficient boiling water to form a thick syrup.

Cup Pudding.

Materials.—One cup finely chopped suet, 1 cup sugar, 1 cup flour, 1 cup white bread crumbs, 1 cup mixed dried fruit, 1 teaspoonful spice, 1 teaspoonful carbonate of soda, 2 cooking apples, 1 egg or ¼ cup milk, ½ cup water, 1 tablespoonful of caramel (browned sugar and water).

Utensils.—Knife, bowl, wooden spoon, basin, pudding cloth or greased paper, saucepan or steamer.

Method.—

1. Peel and cut apples up finely; prepare dried fruit.
2. Put flour, sugar, breadcrumbs, dried fruit, spice, soda, apples, and chopped suet into a bowl.
3. Add egg or milk, water and caramel; mix well.
4. Put mixture into a greased basin; cover with pudding cloth, tied down securely or with greased paper.
5. Boil for three hours or steam for four hours.
6. Turn out; serve hot with sweet white sauce or custard.

French Apple Tart.

Materials for Pastry.—Six oz. flour, 3 oz. lard, 2 tablespoonfuls sugar, yolk of 1 egg, ¼ cup milk, 1 teaspoonful cinnamon.

Utensils.—Bowl, cup, whisk, rolling-pin, knife, tin plate.

Method.—

1. Rub lard, sugar, and salt into flour.
2. Mix with beaten yolk of egg and milk.
3. Turn out on floured board; knead; cut in half; roll out one part.
4. Cover a tin plate with this part; add apple mixture.
5. Roll out other part; cover the fruit; make a hole in centre; brush over; decorate.
6. Bake in a moderate oven thirty to forty minutes.
7. Sprinkle with sugar and cinnamon.

Apple Mixture.

Materials.—One lb. apples, ½ lemon, 2 tablespoonfuls sugar, 1 teaspoonful butter, 1 tablespoonful each of sultanas and currants, ¼ teaspoonful of spice, nutmeg, and cinnamon, 1 teaspoonful of sliced peel.

Utensils.—Saucepan, knife, wooden spoon, teaspoon, lemon squeezer, lemon grater.

Method.—

1. Put peeled and quartered apples into saucepan.
2. Add sugar, lemon juice and rind, butter, sultanas, currants, candied peel, nutmeg, spice, and cinnamon. Stew till apples are soft; stirring continuously.

Fruit Salad.

Method.—

1. If pineapple is used the stalk end should be cut off and the pulp separated from the core with a fork.
2. Fruit such as apples, pears, peaches, must be peeled, cores or seeds removed, and pulp cut up into small pieces; steel knives should not be used.
3. The pulp of passion fruit or granadillas must be scooped out of the shells.
4. Bananas should be cut into rings crossways, or thin slices lengthways; they must not be added to the other fruit until shortly before the salad is served.
5. When all other fruits are prepared they should be well mixed in a basin; the juice of half a lemon and sugar to taste should be added.
6. Fruit salad may be served in a large china or glass bowl or in small glass dishes with custard or cream; icing sugar is sometimes added.

Lemon Cheese.

Materials.—Two eggs, 2 oz. butter, 2 oz. sugar, juice of a lemon.

Utensils.—Saucepan, wooden spoon.

Method.—

1. Put yolks of eggs, sugar, lemon juice and butter into a saucepan.
2. Stir over fire till thick and smooth.

Jam Roly Poly.

Materials.—Eight oz. flour, 4 oz. suet, salt, ¾ teaspoonful baking-powder, ½ cup water, jam or treacle.

Utensils.—Knife, sieve, bowl, board, rolling-pin, pudding cloth, string, pins, saucepan.

Method.—

1. Skin and chop up suet finely.
2. Sift flour, baking-powder, and salt into a bowl.
3. Rub suet into the flour with the tips of the fingers.
4. Add water slowly; mix into a dry dough.
5. Turn out on floured board; knead.
6. Roll out into an oblong shape about ¼ in. thick; spread with jam to about ½ an inch from the edges.
7. Roll up; press down outer edge and push ends in closely; place in the middle of a pudding cloth dipped in boiling water and sprinkled with flour.
8. Fold cloth round pudding; tie ends firmly with string; pin the cloth together at the middle.
9. Put into a saucepan of boiling water; boil for one and a-half to two hours; serve hot with white sauce.

Lemon Arrowroot Pudding.

Materials.—Half a cup sugar, 1 lemon, 2 tablespoonfuls arrowroot, 2 eggs, 1 dessertspoonful butter, 1 pint boiling water.

Utensils.—Bowl, wooden spoon, cup, knife, grater, whisk, pie dish, tablespoon.

Method.—

1. Blend arrowroot with a little cold water.
2. Add yolks of eggs well beaten, sugar, lemon juice, grated rind, and boiling water.
3. Mix butter well through; pour into a buttered pie dish.
4. When cold put the whites of eggs, stiffly beaten, with two tablespoonfuls sugar on top.
5. Put in a moderate oven until meringue is crisp and of a pale golden colour.

Lemon Sago, or Pineapple Sago.

Materials.—Half a cup sago, 2 lemons, 1 tablespoonful sugar, 2 tablespoonfuls golden syrup, 1 pint water—½ pint for soaking and ½ pint for cooking.

Utensils.—Saucepan, knife, squeezer, mould.

Method.—

1. Wash sago; soak two hours.
2. Wipe lemon; grate rind and squeeze juice into a basin.
3. Put water on to boil in a saucepan.
4. Add sago; cook till transparent, stirring occasionally.
5. Remove from fire; add lemon rind, juice, sugar, and syrup.
6. Pour into a mould; serve cold.

Notes.—

1. If lemons are not procurable a crystal of citric acid may be used.
2. Grated pineapple may be used instead of lemon.

Wholemeal Nut Loaf.

Ingredients.—Two cups wholemeal flour (finely ground), 1 teaspoon cream of tartar, ½ teaspoon carbonate of soda, 1½ tablespoons butter, 1 tablespoon sugar, ½ cup nuts, ½ cup raisins, ½ cup sultanas, 1 tablespoon golden syrup 1 egg, 1 good cup milk.

Method.—Mix flour, sugar, cream of tartar and soda, and rub in butter; add nuts and fruit. Dissolve golden syrup in milk and add to well-beaten egg. Mix all together, put into greased tins with lids on, and bake about three-quarters of an hour in a moderate oven.

A raisin loaf without nuts can be made if desired.

Wheatmeal Fruit Cake.

Ingredients.—Half pound butter, ½ lb. sugar, 1 lb. fine wheatmeal, 6 eggs, 1 teaspoon cream of tartar, ½ teaspoon carbonate of soda, ½ lb. chopped dates, 2 oz. nuts, ½ lb. raisins, ½ lb. currants, 1 oz. mixed peel.

Method.—Beat butter and sugar to a cream. Add eggs, one at a time, and beat for ten minutes. Add fruit, nuts and peel, and wheatmeal, cream of tartar, carbonate of soda, and a little milk if necessary. Put into greased tin and bake for one and a-half to two hours.

Wheat "Coffee."

Ingredients.—Three large cups of wheat, 2 tablespoons treacle, 1 tablespoon golden syrup, 3 teaspoons salt.

Method.—Wash wheat; drain and put into shallow baking dish, sprinkle salt on and mix in treacle and golden syrup, covering well all the wheat. Put into a hot oven and cook for one hour to one and a-half hours, stirring to prevent burning. When well cooked and the colour of the coffee bean when well roasted, remove from oven and allow to cool. Grind through wheat mill and store in sealed tins to keep in the strength.

Use one dessertspoonful of wheat "coffee" powder to each person, and add the hot milk to the coffee when ready to serve.

Summer Fruit Drinks.

Nothing is more refreshing or pleasing in warm weather than a well-prepared fruit drink, while from a health point of view the habit of drinking fruit juices needs no stressing. Their wholesomeness may be particularly emphasised as beverages for children, who, left to their own devices, are quick to acquire the taste for them. Many so-called orange and lemon drinks contain no fresh fruit at all, but are made from chemicals and artificial colouring matter. Not only do they not have the food value that the real fruit possesses, but they may be definitely injurious to the child's health.

The only drinks of this kind that the child should be permitted to have should be made from the fresh fruit juice. Mothers who make real fruit juice drinks for their children will not be teased for artificial soda and other harmful drinks. Fruit juices not only satisfy thirst; the natural fruit acids they contain supply beneficial elements to the child's diet.

Pineapple Drink.—Wash the skin of pineapple. Place in a lined saucepan with the core and enough cold water to cover. Cook slowly three-quarters of an hour. Add 3 tablespoons or more sugar and the juice of 1 orange or lemon. Strain and allow to cool. Chill and serve.

Fruit Punch.—Take ½ cup lemon juice, 1 cup orange juice, grated rind ½ orange, 1 tablespoon grated lemon rind, 1 quart water, 3 or 4 cups of sugar. Cook water and sugar for 3 minutes, cool and mix with orange and lemon juice, rind, &c. To this add the following ingredients:—(1) 1 quart ginger ale, ¼ cup preserved ginger cut up finely, (2) 1 cup grated pineapple, 1 pint soda water.

Fruit Cup.—Take 2 lemons, 1 quart boiling water, 2 oranges, 4 passion-fruit, 1 ripe pear (if available), 4 tablespoons sugar, few drops cochineal. Wash lemons, peel thinly into a large jug or bowl; squeeze juice and place it in jug with rind and sugar; pour the boiling water over this and cover till cold. Strain into glass jug, colour very pale pink, add slices of oranges, passion-fruit pulp and cut pear or other fruit. Place in ice chest and serve very cold.

WHAT WE OWE TO TREE PLANTERS.

"Redgum," writing in the "Sydney Morning Herald," has this to say on our debt to the people who plant trees:—

Every man and woman interested in the planting of trees for economic purposes or for beautification has reason to be pleased with the planting work that has been done during the season now drawing to a close.

Not for many years has so much attention been paid to the planting of ornamental trees on the roadways of the State (New South Wales). In parklands, also, splendid work has been done.

At Parkes, Albury, Peak Hill, Armidale, Tamworth, Orange, Blayney, Bathurst, Nowra, Lithgow, Blackheath, Springwood, Penrith, Faulconbridge, West Maitland, Grafton, Blaxland, Crookwell, Manly, Collaroy, Katoomba, and Glenbrook additions have been made, or are to be made, to the arboreal beauty of the towns because the men who are working to bring their home areas into line with the new tree thought of the day, have realised that the only effective way of adding permanent and abiding beauty to Brewarrina, Bourke, Ballarat, or Branxton is to utilise the living loveliness of the trees that seem to find pleasure in the work which their worst enemy, man, now and again gives them to do.

These men are doing something that will one day make their towns more healthy, more beautiful, and more enjoyable. They are but following in the footsteps of the wise men of the yesterdays, who knew the value of trees.

Time and again it has been definitely stated that a town without trees is the town that is the easiest to forget.

It is the beauty of the open road, the parklands, and the town highways that wins favour to-day. Grafton is the best known town in the State, because of her jacarandas; Bathurst's Machattie Park endears her to thousands of travellers and tree lovers; Cook Park makes Orange memorable; a line of shapely poplars keeps Richmond from being forgotten; stately Lombardy poplars tell of Tumut's worth; Belmore Park, Goulburn's pride, is a jewel in jade; Lithgow's acalyphas are hard to forget; Fig Tree's giant scrub fig and its flame tree companion are the two best-known trees between Sydney and Kiama; Blackheath's scarlet oaks are unforgettable; Woollahra's Oriental plane trees add grace and dignity to the roadsides; Parramatta's old English oaks are joyous trees in the spring; and Wahroonga's grey-limbed planes tell their own sweet story to all who have time to interpret it from the signs in the limbs and the leaves.

I was almost forgetting the appeal that the Norfolk Island pines, growing on the ocean beach at Manly, make to the men and women who enjoy the strength and symmetry of such glorious wind and sea loving trees. No wonder that Manly stands alone. The Norfolk Island pine made her famous long before our boys and girls were permitted to tumble into the surf.

A LIVING ART.

The tree is the dominating factor in town and country landscape to-day. No town planning ever will be effective without arboreal embellishments. Tree planting is an art, building stores and Spanish bungalows is all science and solidity. Living decorations laugh at those we make of plaster and paint. If I read the signs on the roadsides aright—I have as good a chance of knowing what is happening in the world where trees and gardens count for something as the next man—to-day's tree planting movement is gaining its momentum because the glory and the beauty of our trees is creeping into the very souls of our men and women, and working, as beauty, love, and loyalty ever will do, a new regeneration in their lives. Love is irresistible. Form and colour are adorable. Spring's gaity and charm are enchanting. Sunlight and shadow are as indispensable as day and night, growing greenness and opening rosebuds are among the most poetic movements in life. Is it any wonder that our men and women are opening their homes and their hearts to the trees?

What really began this great latter-day regeneration, and so stirred the heart of the nation?

Canberra! Colourful, beautiful Canberra! The artist who did the tree planning and tree planting at Canberra opened up new highways into new tree lands that were never dreamed of before. He found the favoured area a wind-swept, brown-bodied sheep run, and left it a great national parkland, made superbly beautiful with trees.

Canberra increases in beauty every year with the natural growth of the sylvan subjects that have been brought together within her gates. This, with the soul that is centred in the capital, make the home of the Federation a city of enchantment. There is nothing to match it in the southern seas. And all because the man who had to do with the tree plantings was big enough in heart and mind to break away from the conventional methods of tree work, and develop new beauty with well-balanced plantings of colourful evergreen, deciduous, and flowering trees.

Canberra is a national influence to-day. Her radiations reach the ends of the continent, her inspirations are working into new forms of loveliness all over the land. How could it be otherwise?

Only a few weeks ago the Prime Minister (Mr. Lyons), with kindliness and good grace, took his place among the nation's tree planters and left a memory tree in splendid company at Faulconbridge, near to the home of the late Sir Henry Parkes, the founder of our Australian Federation. Not often have I seen so simple a ceremony enacted in so fine a spirit. The Prime Minister did the work as one who was greatly honoured to leave a tree in such a hallowed situation.

The Premier (Mr. Stevens) has his tree on the same landscape. Not far away King George's tree stands as the treasure tree of the Blue Mountain highways.

The 1934 tree planting season has been a triumph for the new-day tree planters and for the colourful deciduous and flowering trees. Canberra has been the inspiration behind the best of the work done during the year, for which the tree lovers are glad.

Orchard Notes for December.

THE COASTAL DISTRICTS.

THE planting of pineapples and bananas may be continued, taking care that the ground is properly prepared and suckers carefully selected, as advised previously in these Notes. Keep the plantations well worked and free from weeds of all kinds, especially if the season is dry. New plantations require constant attention, in order to give young plants every chance to get a good start; if checked when young they take a long time to pull up and the fruiting period is considerably retarded. Small areas well worked are more profitable than large areas indifferently looked after, as the fruit they produce is of very much better quality. This is a very important matter in the case of both of these fruits, as with the great increase in the area under crop there is not likely to be a profitable market for inferior fruit. Canners only want first-class pines of a size that will fill a can, and cannot utilise small or inferior fruit, except in very limited quantities, and even then at a very low price. Small, badly filled bananas are always hard to quit, and with a well-supplied market they become unsaleable. Pineapple growers, especially those who have a quantity of the Ripley Queen variety, are warned that the sending of very immature fruit to the Southern markets is most unwise, as there is no surer way of spoiling the market for the main crop. Immature pineapples are not fit for human consumption, and should be condemned by the health authorities of the States to which they are sent.

Citrus orchards require constant attention; the land must be kept well worked and all weed growth destroyed. Spraying or cyaniding for scale insects should be carried out where necessary. Spraying with fungicides should be done where the trees show the need of it. A close lookout must be kept for the first indications of "maori," and as soon as it is discovered the trees should either be dusted with dry sulphur or sprayed with the lime sulphur, potassium, or sodium sulphide washes. Borer should be looked for and destroyed whenever seen.

Early grapes will be ready for cutting. Handle carefully, and get them on to the market in the best possible condition. A bunch with the bloom on and every berry perfect will always look and sell well, even on a full market, when crushed and ill-packed lines are hard to quit.

Peaches, plums, papaws, and lemons will be in season during the month. See that they are properly handled. Look out for fruit fly in all early ripening stone fruit, and see that none is left to lie under the trees to rot and thus breed a big crop of flies to destroy the mango crop when it ripens.

Keep leaf-eating insects of all kinds in check by spraying the plants on which they feed with arsenate of lead.

Look out for Irish blight in potatoes and tomatoes, and mildew on melons and kindred plants. Use Bordeaux or Burgundy mixture for the former, and finely ground sulphur or a sulphide spray for the latter.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

EARLY ripening apples, plums, apricots, peaches, and nectarines will be ready for marketing during the month. They are unsatisfactory lines to handle, as the old saw, "Early ripe, early rotten," applies to all of them; in fact, the season of any particular variety is so short that it must be marketed and consumed as quickly as possible. All early ripening deciduous fruits are poor carriers and bad keepers, as their flesh is soft and watery, deficient in firmness and sugar, and cannot, therefore, be sent to any distant market. The available markets are quickly over-supplied with this class of fruit, and a glut takes place in consequence. Merchants frequently make the serious mistake of trying to hold such fruits, in the hope of the market improving, with the result that, instead of improving, the market frequently becomes more and more congested, and held-over lines have to be sent to the tip. There is only one way to deal with this class of fruit, and that is to clear the markets daily, no matter what the price, and get it distributed and into consumption as rapidly as possible by means of barrowmen and hawkers. Most early ripening fruits are useless for preserving in any way, their only value being what they will bring for consumption whilst fresh. This being so, it is only a waste of time and money to forward immature, undersized, and inferior fruit to market, as it is not wanted, and there is no sale for it. It should never have been grown, as it is frequently only an expense to the producer, besides which, unless the fallen or over-ripe fruit is regularly and systematically gathered and destroyed in the orchard, it becomes a breeding ground for fruit fly and codlin moth, as well as of fungi, such as those producing the brown

and ripe rots. Early ripening fruits should, therefore, be carefully graded for size and quality, handled, and packed with great care, and nothing but choice fruit sent to market. If this is done, a good price will be secured, but if the whole crop—good, bad, and indifferent—is rushed on to the local markets, a serious congestion is bound to take place and large quantities will go to waste.

Orchards and vineyards must be kept in a state of perfect tilth, especially if the weather is dry, so as to retain the moisture necessary for the development of the later ripening fruits. Where citrus fruits are grown, an irrigation should be given during the month if water is available for this purpose, excepting, of course, there is a good fall of rain sufficient to provide an ample supply of moisture.

Codlin moth and fruit fly must receive constant attention and be kept under control, otherwise the later-ripening fruits are likely to suffer severely from the depredations of these serious pests.

Grape vines must be carefully attended to and sprayed where necessary for black spot or downy mildew, or sulphured for oidium. Where brown rot makes its appearance, spraying with the potassium or sodium sulphide washes should be carried out. Leaf-eating insects of all kinds can be kept in check by spraying with arsenate of lead.

Farm Notes for December.

ALTHOUGH November is regarded generally as the best period for planting the main maize crop, on account of the tasseling period harmonising later on with the summer rains, December planting may be carried out in districts where early frosts are not prevalent, provided a known quick maturing variety of maize is sown.

To ensure a supply of late autumn and winter feed, dairymen are advised to make successive sowings of maize and sorghums, to be ultimately used either as green feed or in the form of ensilage. The necessity for such provision cannot be too strongly urged. Farmers who have not had any experience in building an ensilage stack can rest assured that, if they produce a crop for this purpose, information and instruction on the matter will be given on application to the Under Secretary for Agriculture and Stock; also that, whenever possible, the services of an instructor will be made available for carrying out a demonstration in ensilage-making for the benefit of the farmer concerned and his immediate neighbours.

In districts and localities where supplies of lucerne are not available, sowings of cowpeas should be made, particularly by dairymen, as the lack of protein-yielding foods for milch cows is a common cause of diminished milk supplies and of unthriftiness of animals in dairy herds. Cowpeas and lucerne can be depended upon to supply the deficiency. The former crop is hardy and drought-resisting. When plants are to be used as fodder, it is customary to commence to feed them to stock when the pods have formed. Animals are not fond of cowpeas in a fresh, green state; consequently the plants should be cut a day or two before use. Economy is effected by chaffing beforehand, but the plants can also be fed whole. Chaffed in the manner indicated, and fed in conjunction with green maize, or sorghum, when in head, in the proportion of one-third of the former to two-thirds of the latter, a well-balanced ration is obtainable. Animals with access to grass land will consume from 40 to 50 lb. per head per day; a good increase in the milk flow is promoted by this succulent diet. The plant has other excellent attributes as a soil renovator. Pig-raisers will find it invaluable also.

A great variety of quick-growing catch crops, suitable for green fodder and ensilage purposes, may also be sown this month, notably Sudan grass, white panicum, giant panicum (liberty millet), Japanese millet, red and white French millet. Well prepared land, however, is required for crops of this description, which make their growth within a very limited period of time. French millet is particularly valuable as a birdseed crop, the white variety being more in favour for this purpose.

Successive sowings may be made of pumpkins, melons, and plants of this description.

In districts where onions are grown, these will now be ready for harvesting. If attention is given, in the case of garden plots, to bending over the tops of the onions, maturity of the crop is hastened. Evidence will be shown of the natural ripening-off process, and steps should be taken to lift the bulbs and to place them in windrows until the tops are dry enough to twist off. If a ready market is not available, and it is decided to hold over the onions for a time, special care should be taken in handling. Storage in racks in a cool barn is necessary; otherwise

considerable deterioration is to be expected. Improved prices are to be looked for in marketing by grading and classifying produce of this description.

Cotton areas which were subjected to a thorough initial preparation, thereby conserving a sufficiency of moisture for the young plants, should now be making good headway and sending their taprooots well down. Keep down all weed growth by scarifying as long as the growth will admit of horse work.

A LAND LEVELLER.

HOME-MADE, BUT EFFICIENT.

The originator of the idea wrote as follows:—"The type of leveller shown on the top is very good for filling in small furrows. If it is not heavy enough for rough fallow, a log can be tied on the two iron distance pieces, or a board to stand on can be provided. For ordinary work three horses are sufficient. The paddock should be worked from corner to corner—diagonally. The leveller does good work before the drill, and it is better than the harrows for killing weeds, as it crushes them up, leaving the roots clean. A light implement does excellent work after the drill. I have used the leveller of the sort illustrated in the second sketch on this page with

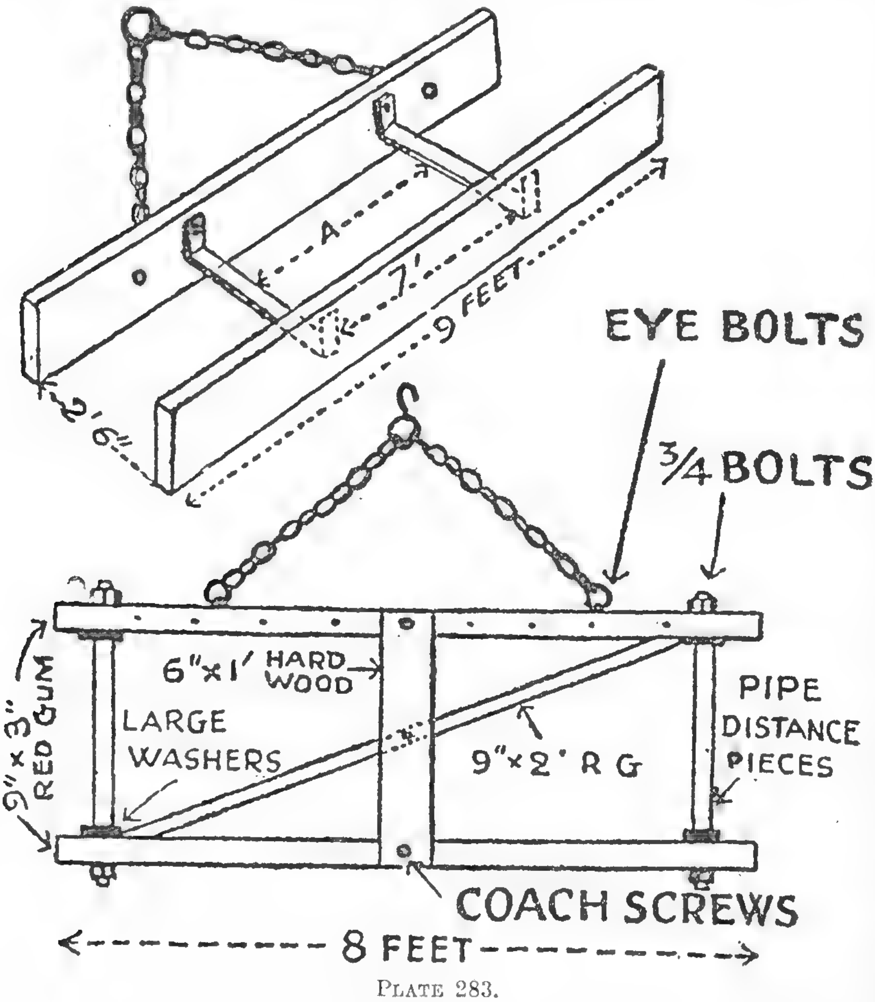


Plate 283.

excellent results on fallow before breaking down. This levels and breaks all lumps on the top, and also loosens the soil before the scarifier or the cultivator. The front piece is studded with old bolts, driven in and allowed to project 2 in. The back piece can be treated the same way. On very hard or rough fallow it is necessary to stand on the implement, or use a seat. It can be weighted to suit dry ground, and takes four to five horses. It can be used in the same direction as the ploughing.—"The Canegrowers Weekly" (Mackay), Q.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF SEPTEMBER, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING SEPTEMBER, 1934, AND 1933, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Sept.	No. of Years' Records.	Sept., 1934.	Sept., 1933.
North Coast.	In.		In.	In.
Atherton	0·66	33	2·33	1·41
Cairns	1·66	52	2·23	2·55
Cardwell	1·54	62	1·92	4·02
Cooktown	0·57	58	0·62	0·38
Herberton	0·52	48	2·46	1·02
Ingham	1·58	42	1·61	6·17
Innisfail	3·49	53	5·48	4·90
Mossman Mill	1·56	21	1·67	5·24
Townsville	0·81	63	0·18	0·92
Central Coast.				
Ayr	1·41	47	0·15	2·40
Bowen	0·83	63	0·67	1·95
Charters Towers	0·85	52	0·02	3·02
Mackay	1·57	63	0·98	1·54
Proserpine	2·17	31	1·18	5·41
St. Lawrence	1·30	63	0.92	1·83
South Coast.				
Biggenden	1·56	35	0·95	2·97
Bundaberg	1·60	51	0·74	1·21
Brisbane	2·02	83	1·33	4·28
Caboolture	1·89	47	0·37	3·16
Childers	1·86	39	0·71	3·27
Crohamhurst	2·74	41	1·04	8·10
Esk	2·13	47	0·94	2·13
Gayndah	1·58	63	2·06	3·45
Gympie	2·15	64	0·42	4·15
Kilkivan	1·72	55	1·03	3·30
Maryborough	1·97	63	1·16	3·73
Nambour	2·58	38	0·96	4·55
Nanango	1·86	52	0·80	4·51
Rockhampton	1·35	63	0·30	1·01
Woodford	2·24	47	0.55	5·07

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Sept.	No. of Years' Records.	Sept., 1934.	Sept., 1933.
Central Highlands.	In.		In.	In.
Clermont	1·05	63	0·18	1·92
Gindie	1·13	35	0·06	5·27
Springsure	1·32	65	0·36	5·18
Darling Downs.				
Dalby	1·69	64	0·80	2·83
Emu Vale	1·76	38	1·67	1·91
Hermitage	1·54	28	1·71	2·01
Jimbour	1·50	46	0·69	1·99
Miles	1·35	49	0·52	1·97
Stanthorpe	2·28	61	2·93	2·20
Toowoomba	2·15	62	0·91	2·34
Warwick	1·83	69	1·16	2·33
Maranoa.				
Roma	1·44	60	0·12	3·52
State Farms, &c.				
Bungeworgorai	1·02	20	0·11	2·94
Gatton College	1·57	35	..	1·89
Kairi	0·63	20	1·68	0·65
Mackay Sugar Experiment Station	1·49	37	1·06	3·01

GEORGE G. BOND, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—SEPTEMBER, 1934.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·97	85	62	89	24	52	6	62	3
Herberton	..	75	55	88	29	44	6	246	9
Rockhampton	30·09	81	58	96	28	45	4	30	4
Brisbane	30·11	75	55	90	27	45	5	133	6
Darling Downs.									
Dalby	30·09	75	46	91	29	35	4	80	5
Stanthorpe	..	67	41	82	29	30	4, 14	293	11
Toowoomba	..	69	47	87	29	37	3, 8	87	5
Mid-Interior.									
Georgetown	29·99	89	63	98	30	53	3, 6	Nil	..
Longreach	30·05	85	54	104	29	39	7	Nil	..
Mitchell	30·09	77	44	97	29	32	4	31	3
Western.									
Burketown	29·99	88	64	97	23, 24	52	7	Nil	..
Boulia	30·02	87	57	105	29	44	7	6	1
Thargomindah	30·06	79	54	97	29	43	7	15	2

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	November, 1934.		December. 1934.		MOONRISE. Nov. 1934.	MOONRISE. Dec., 1934.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	5·3	6·9	4·49	6·33	1·16	12·42
2	5·2	6·10	4·49	6·33	1·46	1·14
3	5·2	6·11	4·49	6·34	2·15	1·44
4	5·1	6·11	4·49	6·35	2·45	2·20
5	5·0	6·12	4·50	6·36	3·16	2·59
6	5·0	6·12	4·50	6·36	3·49	3·48
7	4·59	6·13	4·50	6·37	4·26	4·46
8	4·58	6·14	4·50	6·38	5·8	5·49
9	4·57	6·15	4·50	6·38	5·58	6·56
10	4·56	6·16	4·51	6·39	6·56	8·4
11	4·56	6·16	4·51	6·39	8 0	9·13
12	4·55	6·17	4·51	6·40	9·5	10·19
13	4·55	6·18	4·51	6·40	10·14	11·24
						p.m.
14	4·54	6·19	4·52	6·41	11·19	12·24
					p.m.	
15	4·54	6·20	4·52	6·41	12·23	1·26
16	4·53	6·21	4·52	6·42	1·25	2·26
17	4·52	6·21	4·52	6·43	2·26	3·27
18	4·52	6·22	4·53	6·44	3·28	4 28
19	4·52	6·23	4·53	6·44	4·30	5·28
20	4·51	6·24	4·53	6·45	5·34	6·22
21	4·51	6·25	4·54	6·45	6·35	7·12
22	4·51	6·26	4·54	6·46	7·35	7·59
23	4·50	6·27	4·55	6·46	8·30	8·39
24	4·50	6·28	4·55	6·47	9·20	9·13
25	4·50	6·28	4·56	6·47	10·4	9·46
26	4·50	6·29	4·56	6·48	10·41	10·15
27	4·50	6·29	4·57	6·48	11·16	10·43
28	4·49	6·30	4·58	6·49	11·47	11·10
29	4·49	6·30	4.59	6,49	a.m.	11·40
30	4·49	6·31	4·59	6·50	12·14	a.m.
31			5·0	6·50		12·13

Phases of the Moon, Occultations, &c.

7 Nov. ● New Moon 2 44 p.m

14 ,, ☾ First Quarter 12 39 p.m.

21 ,, ○ Full Moon 2 26 p.m.

29 ,, ☽ Last Quarter 3 59 p.m.

Perigee, 12th November, at 12.45 p.m.
Apogee, 28th November, at 12.18 a.m.

The apparently very near approach of Venus to Jupiter would be most remarkable on November 1st and 2nd if it were not for their nearness to the Sun, which will rise only 16 minutes after the planets.

On the 3rd, Mercury will pass nearly between the Earth and the Sun, but being about half a degree further south will not cross the Sun's face. On the next day Mercury will pass from west to east of Venus, which will be about 1 degree north of it.

When Jupiter rises on the 7th about 4.20 a.m. Mercury will be passing from west to east of it, about a third of a degree on its southern side.

On the 11th, Mars and Neptune will be in the same part of Leo, near the border of Virgo within 1 degree of each other, but with an actual distance of more than 2,500 million miles.

On the 14th, at 4 p.m., Saturn will be only 3 degrees (half the length of the Southern Cross) south of the Moon in its first quarter, in the north-east; a spectacle for telescope or binoculars will then be afforded.

On the 18th, Venus will be on the far side of its orbit beyond the Sun, but about half a degree to the north of it, and about 160 million miles from the Earth. Venus will therefore be unobservable in November.

Mercury will take its place as a morning star, having its greatest elongation 19 degrees west of the Sun, on the 19th.

On the 21st at 4 a.m., Mercury will be apparently within three diameters of the Moon north of Jupiter, which will be an interesting spectacle for those using telescope or binoculars.

Mercury will set 24 minutes after the Sun on the 1st; on the 15th it will rise at 4.1 a.m. or 53 minutes before the Sun.

Venus will rise at 4.52 a.m., or 11 minutes before the Sun on the 1st, and only 5 minutes before it in the 15th.

Mars will rise at 2.16 a.m. on the 1st and at 1.43 a.m. on the 15th.

Jupiter will rise at 4.55 a.m. and set at 5.53 p.m. on the 1st; on the 15th it will rise at 4.9 a.m. and set at 5.13 p.m.

Saturn will rise at 12.16 p.m. and set at 1.30 a.m. on the 1st; on the 15th it will rise at 11.20 a.m. and set at 12.37 a.m.

7 Dec., ● New Moon 3 25 a.m.

13 ,, ☾ First Quarter 8 52 p.m.

21 ,, ○ Full Moon 6 53 a.m.

29 ,, ☽ Last Quarter 12 8 p.m.

Perigee, 9th December, at 6 p.m.
Apogee, 25th December, at 7.36 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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QUEENSLAND AGRICULTURAL JOURNAL

VOL XLII. 1 DECEMBER, 1934. PART 6.

Event and Comment.

An Australian Agricultural Council.

AT a recent conference of Federal and State Ministers at Canberra a proposal to form an Australian Agricultural Council was adopted unanimously. Wide powers and many responsibilities will be given the newly-formed Council, which, it is hoped, will function permanently as a body, having as its objective the promotion of the welfare of agricultural industries and the formulation of national policies. The functions of the Council will be:—

To promote the welfare and development of agricultural industries.

To arrange the mutual exchange of information regarding agricultural production and marketing.

To co-operate for the purpose of ensuring the improvement of the quality of agricultural products and the maintenance of high-grade standards.

To ensure balance between production and available markets.

To consider the requirements of agricultural industries in regard to organised marketing.

To promote the adoption of a uniform policy on external marketing problems, particularly those pertaining to the negotiation of intra-Empire and international agreements.

To consult in regard to proposals for the grant of financial assistance to agricultural industries.

To consider questions submitted to the Council by a new standing committee in agriculture.

The conference decided to create an enlarged standing committee on agriculture, which will be a technical body, to advise the Commonwealth and State Governments and to secure co-operation and co-ordination in agricultural research and quarantine matters throughout the Commonwealth. The standing committee will comprise the permanent head of the State Departments of Agriculture, members of the executive committee of the Council for Scientific and Industrial Research, the secretary to the Department of Commerce, and the Director-General of Health.

Tobacco Experiment Work.

ANSWERING some criticism of departmental activities in respect of tobacco experiment work in the far North, in the course of a recent debate in Parliament, the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, said:—

> Some question was raised as to whether the department should not have taken over the Commonwealth tobacco experiment farm at Mareeba. This Committee is entitled to know why I refused to take this farm over. I was guided in my decision by the considered opinion of experienced agriculturists and experimentalists in all parts of the world. Hon. members will realise that at one time it was a recognised policy in Queensland to have centrally situated experiment farms in each divison of the State. I think the hon. member for Cooroora (Mr. Harry F. Walker) must subscribe to my policy, because during his administration he got rid of two or three experiment farms. I frankly admit that I have got rid of experiment farms since I have been Minister. My reason is that, after all, an experiment farm generally only has one soil type. The result is that notwithstanding considerable expense to the State it may be of very little value in another district, perhaps not 100 miles distant. Experimental work, to be of any advantage, must deal with various soil types and a diversity of agricultural subjects, rather than with one soil type in one climate. It was because those reasons were uppermost in my mind, to which I ardently subscribe, that I refused to take over the Mareeba tobacco experiment station. Several years of experimental work had been done there. That work had not been materially successful. There was one phase, even if other phases did not exist, that induced me to reject the Commonwealth offer. It was a fact that after six or seven years' extensive cropping disease problems of outstanding importance would have hampered any cultural operations we were conducting. The Commonwealth Government has undertaken research work into disease problems in the tobacco industry, and have delegated to the State the cultural work that is necessary. If we are to undertake the cultural work it would not be fair to suggest that we should undertake that cultural work handicapped by having to use an old experimental station that in its earlier days had been saturated with disease spores that are difficult to control, as, for example, frog-eye and blue mould. Speaking from memory, we

have twenty or thirty tobacco plots under experimental observation, and I think our present policy of having the tobacco experimental work scattered throughout the whole of the State is a better policy than its concentration in one area.

I believe that the whole experiment policy of the department, not only in regard to pasture improvement but also in regard to cultural experimental work generally, should be distributed over the widest possible area. There should be no centralised experiments for cultural work. Experiments for pathological observation and research on the other hand should be conducted within easy reach of the most highly skilled officers in my department, who are the men in control of the branches at the head office. That is a policy I have pursued. It is certainly an expensive one. All agricultural research work, indeed all research work, is expensive, but I view the question in this way—and my officers fortunately share my views—that it is not expenditure in the true sense of the word. Rather is it an investment, and if we did not strenuously continue an experimental policy in all its various facets, then agriculture would decline instead of progress.

The Year in Agriculture.

IN the Annual Report of the Department of Agriculture and Stock, the Under Secretary and Director of Marketing, Mr. E. Graham, states that, if viewed solely from the production standpoint, the year was a successful one in practically every branch of rural industry. This result was due to favourable seasonal circumstances, a steady improvement in farming efficiency, and higher standards of animal husbandry, which are becoming more evident every year.

The administrative, advisory, research, and regulatory functions of the Department have been maintained in accordance with the State's broad and comprehensive policy of sound rural development.

The interval between the discovery and application of new knowledge of practical value has been reduced by close correlation of the research and advisory services in respect of the varied and extensive activities of the Department.

The departmental year has been marked, too, with a sincere, sustained, and, to some extent at least, successful endeavour to surmount the perplexities of the economic position. Economically, the agricultural situation is still very serious. The price position, in the dairy and fruit industries particularly, is far from satisfactory. Improved wool values have had, however, a stimulating effect.

Although marketing difficulties continue—difficulties that shall certainly be increased should a policy of further restriction of exports and regulation of crop acreages be enforced—there is some evidence that the worst of the depression, which has affected agriculture in common with other industries so seriously in recent years, has passed.

Every effort to improve the marketing position of all primary products, in the best way possible in the circumstances, was made during the past year. In this connection, it is repeated that Queensland farmers are fortunate in their system of organised marketing which has proved, during recent difficult years, the best protection that they could have.

Queensland Fruit Fly Control.

By ROBERT VEITCH, B.Sc., Agr., B.Sc., For., F.R.E.S.,
Chief Entomologist.

THE maggots of the Queensland Fruit Fly feed voraciously in the fruit of many trees and other plants, deciduous fruit being particularly susceptible to attack. Citrus, papaw, and mango may also suffer severely, but fortunately the banana is very rarely attacked and then only in the case of over-ripe bunches, which should be cut solely for home or local consumption. The maggots tunnel throughout the fruit, destroying much tissue in their progress and setting up decomposition, the combined effect being to render the fruit unfit for marketing.

Life History and Habits.

The creamy coloured slightly curved eggs of the Queensland Fruit Fly are laid in batches of as many as six or seven in the tissue of the selected fruit just underneath the puncture made in the skin thereof by the female fly. The eggs hatch in two or three days in midsummer, and the creamy white legless tapering maggot feeds throughout the tissue of the fruit. The full size of about one-third of an inch in length is attained in a week in the warmer weather, and the maggot then leaves the fruit and pupates in the soil just below the surface. The pupa is formed within a hard-shelled reddish-brown pupal case, and in this non-feeding stage the maggot's tissues undergo a complete reorganisation resulting in the production of the prettily marked reddish-brown fly at the end of about one week in midsummer. The life cycle may thus be completed in a fortnight in summer, but in the colder months all the life-cycle stages are of much longer duration.

Disposal of Infested Fruit.

Successful control of this pest necessitates strict attention to orchard hygiene, and all waste and fly-infested fruit should accordingly be promptly gathered up and adequately disposed of. If fallen infested fruit is allowed to lie on the ground the fruit-fly maggots contained therein will leave the fruit on becoming full grown and will pupate in the soil to produce a fresh brood of flies. When the infested fruit has been gathered up it may be disposed of by burying, boiling, burning, or immersing in water. If the fruit is buried care should be taken to ensure that it has a soil covering of at least 18 inches, for if only a light covering is given the flies will succeed in completing their development and emerging from the soil. None of these methods of disposal are ideal, and hence it has been decided that, at least in so far as the Stanthorpe district is concerned, the pit method of disposal is more satisfactory. The pit should be 6 feet by 5 feet with a depth of 20 feet, and a suitable fly-proof cover should be provided. The waste and infested fruit soon ferments when tipped into such a pit, and the fruit-fly maggots are killed by the fermentation process. Pits of somewhat smaller dimensions are employed in the citrus districts; boiling is also a favourite method of disposing of fly-infested citrus.

Luring.

Luring has been demonstrated to be a successful control measure in the deciduous fruit orchards, and a departmental lure much used

therein has the following formula for a five to one strength:—Five tablespoonfuls of liquid household ammonia; five teaspoonfuls of imitation vanilla essence, and 26 ounces of water—i.e., one winebottleful. An eggcupful of the concentrated lure prepared according to that formula is added to five eggcupfuls of water, and that quantity is sufficient for the baiting of one trap. The lure is placed in glass fly traps, which are generally obtainable at a cost of 1s. 6d. each, and these are placed in suitable trees. Large leafy trees in a sheltered position should be selected and the traps placed in the shadiest portions thereof, being suspended by tie wire. The traps should receive regular attention, the lure being renewed as required.

Readers are reminded that this lure was evolved for use in deciduous fruit orchards, and its application in citrus and other orchards may not be attended with the same degree of success as has been experienced at Stanthorpe. Furthermore, in citrus orchards the best trees for luring may be those in the most exposed position, whereas, as already indicated, sheltered trees are the most suitable in the deciduous fruit orchards. The suitability of particular citrus trees for luring purposes may be determined by observing the amount of fallen fly-infested fruit under the trees.

Repellent Sprays.

Repellent sprays have already been the subject of departmental experiments at Stanthorpe and in connection therewith readers may be interested to know that ½ pine of nicotine sulphate and ½ gallon of white spraying oil to 40 gallons of water gave very promising results as a fruit-fly repellent in a Severnlea apple orchard. Before this repellent spray can be recommended as safe and effective these experiments will, of course, have to be repeated to decide whether this particular spray will live up to the early promise of success and, furthermore to determine whether or no any cumulative ill-effect is produced by the oil in the repeated applications necessary at intervals of one week during the course of a fruit-fly invasion. The effect on fruit other than apples will also have to be determined.

Elimination of Non-commercial Fruit Trees.

Where practicable all useless non-commercial fruit trees known to breed fruit flies should be eliminated, for they merely act as an additional source of infestation for the commercial trees.

Covering Trees.

Covering the trees with such material as old mosquito-netting will prevent the flies gaining access to the fruit for egg-laying purposes. Such a control measure, of course, can be adopted only in cases where a few small garden trees require protection.

Parasites of Cattle.

By F. H. S. ROBERTS, M.Sc., Entomologist, Animal Health Station, Yeerongpilly.

EXTERNAL PARASITES.

The most important external parasites of cattle are lice, mange mites, ticks, and the buffalo fly.

LICE.

Three distinct species of lice infest cattle. Two of these, *Hæmatopinus eurysternus* and *Linognathus vituli,* are sucking lice. The third species, *Bovicola bovis,* is a biting louse.

The Biting Louse (Bovicola bovis).

PLATE 284.—THE BITING LOUSE (*Bovicola bovis*).

This is a small yellowish louse with a broad, blunt, reddish-head. This species usually infests the withers and rump, sometimes extending along the back between these two sites. Their presence causes a scurfy condition of the skin; and the constant rubbing and scratching by the irritated animal may cause the formation of raw hairless patches. Eggs laid by the female louse are glued to the hairs and hatch in about ten days.

Sucking Lice.

The two species of sucking lice are quite distinct in appearance, so much so that *Hæmatopinus eurysternus* (Plate 285) is called the short-nosed sucking louse and *Linognathus vituli* (Plate 286) the long-nosed sucking louse.

The short-nosed sucking louse may measure up to $\frac{1}{8}$ of an inch in length. The head is short, bluntly-pointed, and about as broad as long. The abdomen is greyish in colour, the head and thorax yellow. The eggs

hatch in about eleven to eighteen days, and the young lice become mature in another twelve days. This species is usually found on adult cattle.

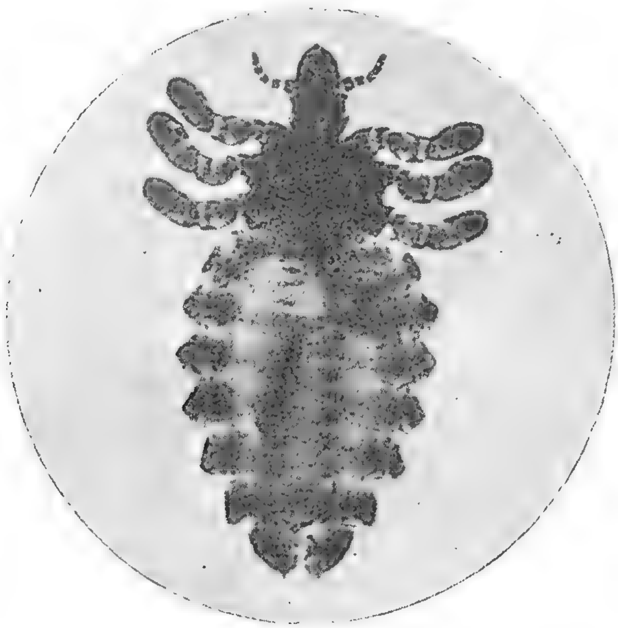

Plate 285.—The Short-nosed Sucking Louse (*Hæmatopinus eurysternus*).

The long-nosed sucking louse is a smaller and more slender species, the head being about twice as long as broad. The eggs hatch ten to fourteen days after being laid by the female, and the young lice reach the mature stage in another eleven days. This is the sucking louse commonly met with on calves and young cattle.

Plate 286.—The Long-nosed Sucking Louse (*Linognathus vituli*).

For the most part sucking lice infest those portions of the body from which it is difficult for the animal to dislodge them. They usually feed in groups and are found on the head, sides of the neck, brisket, back, tail, scrotum, and inner surfaces of the thighs. The tail is a favoured site of attack, and it is not uncommon in cases of heavy infestation to see the switch of the tail literally covered with eggs.

When feeding, the lice, by means of their piercing and sucking mouthparts, pierce the skin and suck up the blood and fluids. Their habit of feeding in clusters not only increases any irritation and annoyance that follows the insertion of the mouthparts into the skin, but may also cause the formation of large scabby areas. In general, sucking lice may so lower the vitality of the infested animals that these are unable to withstand unfavourable conditions, eventually becoming poor and unthrifty.

Control of Lice.

The main method of spread is by contact between infested and clean animals, but it must be remembered that lice are able to live a few days if separated from their hosts. For this reason stables, &c., in which lousy cattle have been housed should be thoroughly cleaned out and disinfected to kill any dislodged lice and eggs.

Moderate and confined infestations of individuals may be treated with oils (sump oil, crude oil) or dip washes; for herd infestation dipping in an arsenical dip will be found satisfactory. The treatment should be repeated after fifteen-day intervals, at least two treatments being required.

MANGE.

Mange is caused by small species of mites which live under or on the skin. This disease condition is not considered to be prevalent among cattle in Queensland.

Before any treatment is attempted it is necessary to determine the type of mange present. This can only be done by taking skin scrapings and forwarding them to the laboratory for diagnosis.

Mange usually occurs on areas where the skin is tender and the hair is sparce. The infested skin becomes inflamed and swollen and scabs are formed. Eventually the skin becomes thickened and thrown into folds.

Dipping in a lime sulphur dip is necessary to control mange.

THE CATTLE TICK (Boophilus microplus).

A B

PLATE 287.—THE CATTLE TICK (*Boophilus microplus*).

Description.

Several species of ticks have been recorded from cattle in Queensland, the most common and most important species being the common cattle tick, *Boophilus microplus* (*B. australis*). The female tick (Plate 287 (B)) at first is small, grey in colour, with a few irregular yellow markings. As she engorges with blood the grey colour changes to a dark-red, and when fully engorged this sex may measure about half an inch in length. The male (Plate 287 (A) is minute in size, measuring about one-tenth of an inch. In both sexes the mouthparts are placed at the narrower anterior end of the body and are brownish in colour and inconspicuous. The pale, flesh coloured legs readily distinguish the common cattle tick from other species of ticks, such as wallaby ticks, kangaroo ticks, the dog tick, &c., that are occasionally seen on cattle.

Life History.

The female tick when fully engorged drops from the host and crawls to some sheltered spot to begin her egg laying. The eggs are spherical brownish bodies and are deposited in masses, as many as 4,000 being laid by a single female. Under favourable conditions these hatch in about fifteen days, and the tiny six-legged larvæ or seed ticks emerge. After a time, sufficient for the body parts to harden, the larvæ crawl up the grass from which they are brushed on to the animal as it passes by. These larvæ are very tenacious of life and may live as long as 154 days in the absence of cattle. Once on the beast the tiny ticks distribute themselves over the body, seeking spots where the skin is soft and thin. Having found a suitable place the proboscis is inserted and the young tick commences to suck blood. After about six to ten days the larva is fully engorged. It then casts its skin and the next stage in the life history—the eight-legged nymph—appears. The nymph reattaches itself to the same spot on the animal or near it and becomes engorged after about another seven days. A second moult then occurs and the adult stage makes its appearance. Reattaching herself the female tick may be fully fed in seven to ten days. She then drops from the animal, lays her eggs, shrivels up, and dies. The male, on the other hand, following the moulting of the nymph, feeds intermittently and spends its life searching out the females.

The Economic Importance of the Cattle Tick.

The cattle tick first entered Queensland from the Northern Territory in 1891, and at the present time has spread throughout the coastal and northern portions of the State.

It is an extremely important pest of cattle and heavy infestations cause tick worry and anæmia, which may in themselves be serious enough to result in death. Among dairy cattle this tick may produce a serious decrease in the milk yield.

Its greatest importance, however, lies in the fact that it is a vector or carrier of two organisms which are responsible for serious diseases among cattle. These organisms are *Babesia bigeminum* and *Anaplasma marginale*,* which produce "redwater" and anaplasmosis, respectively, in cattle.

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* Although the common cattle tick is not as yet implicated in the spread of Anaplasmosis in Australia, experiments conducted in the United States have shown it to be able to transmit this disease.

THE BUFFALO FLY (Lyperosia exigua).

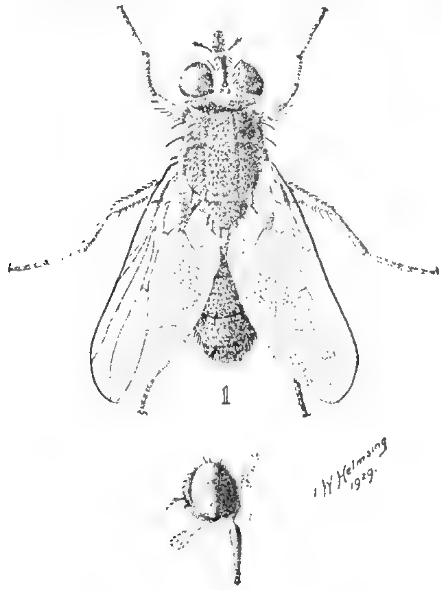

PLATE 288.

(1) Adult × 8. (2) Lateral view of head showing sucking mouthparts.

The buffalo fly affords an excellent example of an insect which, whilst unimportant in its native country, has upon introduction into a new land become a pest of serious dimensions. In the East Indies the fly is almost unknown as a harmful parasite of stock, but in Australia it bids fair to rival the cattle tick as a stock pest of outstanding importance. The reason for this may probably lie in the freedom it enjoys in Australia from the attacks of other insects which in the East Indies so parasitise it as to keep it under control. An alternative explanation may be found in a climatic or some other condition present in Australia which is more favourable to its development and rapid increase.

The buffalo fly belongs to the dipterous family Muscidæ, which, besides the house fly, the bush flies, and blowflies, includes a number of biting flies, other species of which are the stable fly of cosmopolitan distribution and the infamous tsetse flies of Africa.

The genus *Lyperosia* contains representative species in various parts of the world. *Lyperosia exigua* is known from the East Indies and Australia; *Lyperosia irritans*, the "horn fly" of the United States, was introduced from Europe and is a serious pest of cattle in the former country. Three further species occur in the Soudan, all very common, but not regarded as very important parasites of native stock. One of these species, *Lyperosia minuta*, has been introduced to the Transvaal and Zanzibar, but in the latter country only is it regarded as a harmful pest of cattle.

Distribution in Australia.

The buffalo fly is thought to have been introduced into Australia with the first herd of buffaloes which landed at Darwin somewhere

about 1825. For many years it remained confined to the country in and around Darwin, and it was not until 1911 that it attracted attention as a pest of cattle. At this time it occupied a range of country extending from the Liverpool River on the east to the Daly River on the west and bounded on the south by the Roper River, the coast line, of course, representing the northern limit. During the next fifteen years extensive movements of cattle occurred and the fly rapidly spread, so that at the end of this period its area of distribution extended from Broome, West Australia, to the Robinson River on the east, and to the watershed of the coastal rivers on the south—an area practically four times as large as that occupied in 1911. It first crossed the far north-western border of Queensland in 1928, and at the present time is confined to this corner of the State.

Description and Habits.

The buffalo fly is a small dark-grey, biting fly, a little more than half the size of the ordinary house fly. (*See* Plate 288.) Primarily a parasite of the buffalo, the insect has turned its attention to other animals, including cattle, horses, and man, for the purpose of obtaining food, cattle constituting the principal host. Horses and man are usually attacked only at such times as they are among infested cattle.

Unlike other biting flies such as mosquitoes, march flies, and sandflies, which visit the host only at such time as food is required, the buffalo fly remains on the animals night and day, and only when disturbed or for the purpose of laying eggs does it leave the host. When not feeding they rest in groups on the neck, shoulders, bellies, rumps, and horns. Both male and female flies feed on blood, and for this purpose they force their way down among the hairs, elevate the wings, and assume an almost erect position. When disturbed the speed of their flight is astonishing, for although covered by the hairs of the hide, at a switch of the tail or a toss of the head, the flies instantly rise in a cloud for some little distance, returning again as quickly and resuming feeding.

Life History.

The Egg.

The egg of the buffalo fly is a tiny, elongate, creamy yellow body, and is deposited by the female in the freshly-dropped dung of cattle and buffaloes. It was thought that the dung of native animals—kangaroos, wallabies, &c.—and that of horses might prove suitable for the development of the fly, but so far attempts to breed the flies under natural conditions from the dung of these animals have been negative. Unlike bovine fæces, this type of dung is apparently too dry for larval development. As soon as fresh fæces are dropped, the female flies leave the animal to lay their eggs therein, the egg being deposited either on the surface or else in cracks and crevices. A number of eggs may be deposited in the one spot by a single female, which may lay many such batches in the one season. Under suitable conditions of temperature and moisture the egg may hatch in eighteen to twenty-four hours. Dryness and exposure to sunlight are harmful to the egg, which under such conditions rapidly decomposes.

The Larva.

The larva is a typical fly maggot, small in size and dirty white in colour. On hatching from the egg it immediately burrows into the dung, and keeps on burrowing as the surface layers dry out. Growth occurs fairly rapidly, and in three to five days the maggot is fully grown and ready to pupate.

The Pupa.

When ready to pupate the fully-grown maggot may either remain in the dung or else descend into the soil. The larval skin contracts, hardens, and turns brown. Within this brown, hardened case transformation of the larva to the adult takes place. This stage occupies three to five days, at the end of which the adult fly emerges, dries its wings, and is ready for its parasitic existence.

Duration of Life Cycle.

The complete life cycle occupies seven to eleven days under favourable conditions, the period, of course, being lengthened during the winter months or at any such times as the conditions are adverse to the fly's development.

Seasonal Distribution.

Although the buffalo fly is never quite absent throughout the year, there is a very marked seasonal variation. During the dry winter months the insects are so scarce as to warrant a most careful inspection of individual animals to detect their presence. Commencing with the advent of the rainy season in November they become more numerous, and in the wet months of January and February are at their maximum, gradually becoming less frequent with the approach of May and June.

Economic Importance.

No evidence has yet come to hand that the buffalo fly may be a vector of some deadly disease, but the possibility should always be borne in mind. The cattleman is only too familiar with the worry and irritation cattle suffer through the occasional attacks of mosquitoes, sandflies, and march flies, and with this knowledge the harm that such a parasite as the buffalo fly in its countless numbers and constant attendance may accomplish can well be imagined. Infested animals lose condition fairly rapidly, not only as a result of the blood-sucking habits of the flies, but also through the worry and irritation caused by their presence. When the pest is present in numbers, cattle are kept constantly on the move and feed only at such times as they may gain respite from the fly's attack. As a loss in the milk yield is associated with the presence of the horn fly in the United States, it is reasonable to assume that a similar loss in yield also occurs in the case of the buffalo fly. Moreover, its bite is particularly severe, and the efforts of the beasts to rid themselves of its presence by rubbing the affected parts against posts, tree trunks, &c., causes the formation of large raw areas which attract other muscid flies—the bush fly and blowflies—which are conducive of further distress. Buffalo fly attack is already producing a noticeable effect on the cattle industry of the North, and

should the infestation ever include the dairy and main beef herds of Queensland the loss will become very serious.

INTERNAL PARASITES.

So far as can be ascertained, cattle in Queensland are not affected by internal parasites to the same extent as any of the other domesticated animals. Little is known of the prevalence of worms among the beef herds, but as these cattle are confined for the most part to the driest part of the State it is not considered that worms would be of any economic importance in so far as they are concerned. The dairy herds, on the other hand, occupy country with a comparatively high rainfall. Calves are weaned almost at birth and are subjected to treatment which would considerably lower their resistance to infestation, and it is mainly among animals of this class that losses following worm infestation are reported.

FLUKES.

Two species of flukes occur in cattle, the conical fluke, *Paramphistomum cervi,* and the liver fluke, *Fasciola hepatica.*

The conical fluke (Plate 289), as its name implies, is conical in shape and is found in the large or first stomach. It is extremely common in Queensland and is often present in very great numbers. It is, however, not considered to be harmful to any noticeable extent.

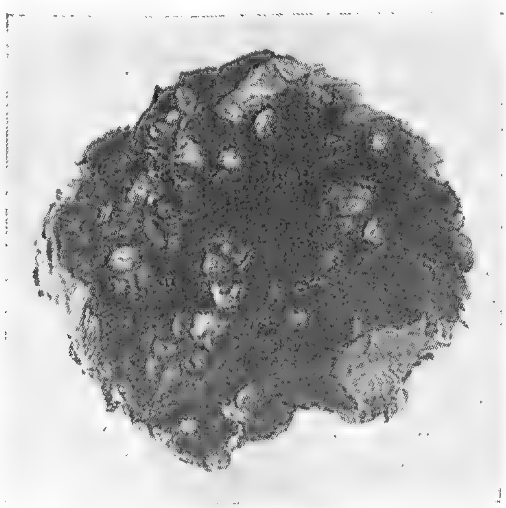

PLATE 289.—THE CONICAL FLUKE (*Paramphistomum cervi*).

The liver fluke occurs in the bile ducts of the liver, and is the same species as is found in the liver of sheep. Fortunately, it is of little importance, as it is of rare occurrence only.

With both species a snail is necessary as the intermediate host before the life cycle can be completed.

TAPEWORMS.

Cattle may act as the intermediate host of at least two very important tapeworms. The first of these is an extremely important parasite of man and is known as the beef tapeworm, *Tænia saginata*. Its larval form, *Cysticercus bovis*, is found in various parts of the body of cattle, usually in the muscles. Fortunately, beef measles, which is the name given to the infestation of cattle with the larval tapeworm, is unknown in Queensland.

The second species of larval tapeworm found in cattle is called *Echinococcus granulosus*, the common name given to this stage in the life history being "hydatids." The adult tapeworm occurs in the dog, and as hydatids is also a very important disease of man and propagated mainly through feeding raw offal containing the larval stage to dogs, control is only possible when all offal is thoroughly cooked before being fed to the dog. In cattle, the liver and lungs are the principal portions of the body infested with the larval stage which takes the form of cysts or bladders of fluid.

Calves are occasionally infested with adult tapeworms, *Moniezia* spp., which are found in the small intestine. These tapeworms may grow up to 10 feet or so in length, but it is doubtful as to whether they are of any great importance, though in one or two instances in which very heavy infestations were encountered the animals were emaciated and were subject to frequent attacks of scours.

Treatment for Tapeworms.

Calves infested with tapeworms should be starved for twenty-four hours and then given 3 to 4 oz., according to age, of the following preparation. Food and water should be withheld a further four hours after treatment:—

White arsenic (95 per cent. to 98 per cent. arsenious acid)	2 oz.
Epsom salts	6 lb.
Water	5 gallons.

Boil the arsenic for half an hour in 2 gallons of water. Allow the sediment to settle, then pour off and retain the clear fluid. Add the Epsom salts and make up to 5 gallons.

ROUNDWORMS.

Of the numerous species of roundworms that occur in cattle many are inconspicuous and of little importance, and have been omitted from these notes. Others, while producing no outstanding symptoms of infestation, are included owing to their comparatively frequent occurrence.

THE LARGE STOMACH WORM (Haemonchus contortus).

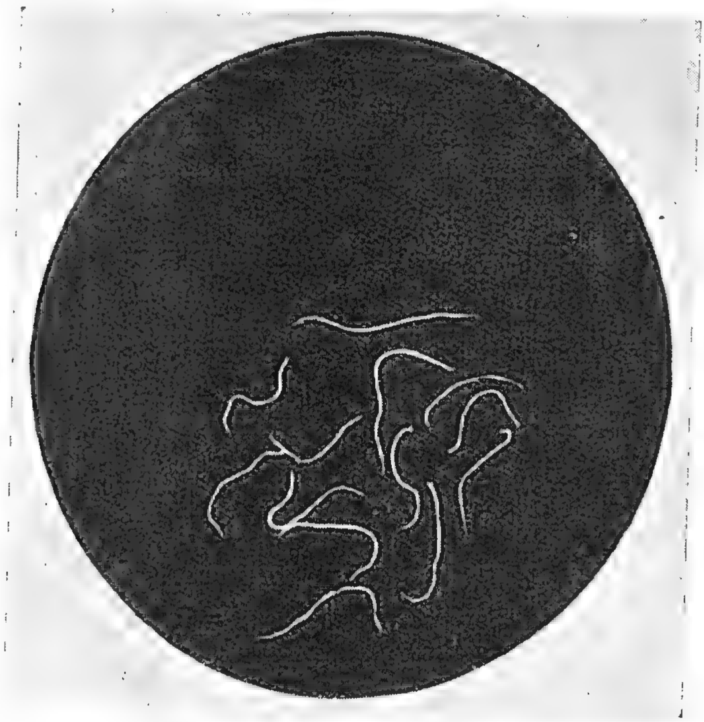

Plate 290.—The Large Stomach Worm (*Hæmonchus contortus*).

The large stomach worm is found in the fourth stomach, and not only occurs in cattle but also in sheep and goats. Of the two sexes the female is more conspicuous, being red and white striped and about an inch in length. The male is smaller and uniformly pinkish or whitish.

Life History.

The eggs laid by the female worm eventually reach the exterior in the dung. Under favourable conditions these hatch and give rise to tiny larvæ. These larvæ feed and develop in the dung and in a few days reach the infective stage, the larva now being completely enclosed in a sheath, which helps to protect it against adverse conditions. Crawling up the grass blades, when moisture is present, the larvæ are taken in by the animal when grazing. Making their way to the fourth stomach they settle down and grow to maturity.

Effect of Infestation.

Only calves and young cattle appear to be affected by the large stomach worm. A heavy infestation causes continuous diarrhœa, anæmia, and emaciation, and also may manifest itself in a large swelling beneath the jaw (bottle jaw), and unless treated the animal may die.

Treatment and Control.

Bluestone will be found a satisfactory drench for the large stomach worm. This is made up as follows:—Bluestone (fresh), 8 oz.; water, 3 gallons.

If desired, 8 oz. of mustard may be included. The bluestone should be dissolved in the water in an enamel or earthernware vessel. The mustard is mixed to a smooth paste and then added to the bluestone solution, keeping the mixture well stirred whilst using. The animals to be treated should be starved for twenty-four hours before and for four hours after treatment, the dosages being as follows:—Calves four months, 3 oz.; calves six months, 4 oz.; calves nine months, 6 oz.; calves twelve months, 8 oz.

This treatment should be repeated at least once after a fourteen days' interval.

In addition to treatment preventive measures should be adopted, the most important of which are—

1. The avoidance of paddocks of a marshy nature as calf pastures.
2. The burning off of the pastures when possible, such burnt off areas to be used only by the calves.
3. Losses due to stomach worm infestation occur mainly in the late winter and early spring; that is, at a time when the pastures contain very little nourishment. It is believed that the use of supplementary foods during this period, especially to "poddies," would considerably increase the resistance of the animal to the effects of infestation. A good bonemeal lick should always be available to the animals as well.

THE LESSER STOMACH WORM (Ostertagia ostertagi).

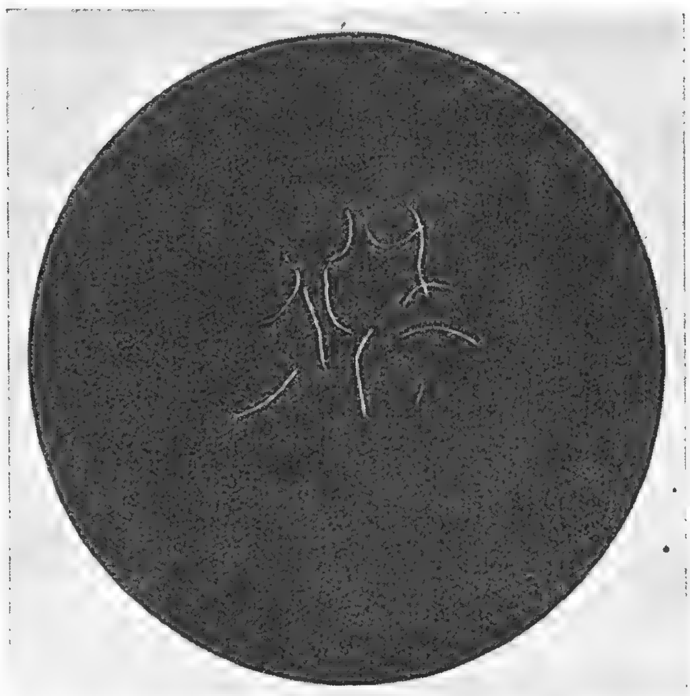

PLATE 291.—THE LESSER STOMACH WORM (*Ostertagia ostertagi*).

This is a slender brownish worm found buried in the mucosa of the fourth stomach. Although one of the commonest parasites of cattle in Queensland it is not considered to be of any importance. The life history differs only in detail from that of the large stomach worm.

THE CATTLE HOOKWORM (Bunostomum phlebotomum).

Plate 292.—The Cattle Hookworm (*Bunostomum phlebotomum*).

This is a conspicuous whitish species about half an inch to nearly an inch in length occurring in the first portion of the small intestine. The mouth of the hookworm is provided with teeth with which it attacks the intestine wall.

Life History.

The eggs laid by the females are passed out in the dung. After hatching the larva develops into the infective stage when it is enclosed in a sheath. Should these infective larvæ come into contact with the skin of the host, they immediately bore through it and reaching the blood vessels are carried to the lungs. After developing in the lungs for some time they move out into the windpipe or trachea and from here to the mouth. They are then swallowed, and reaching the intestine settle down and grow to maturity.

Infective larvæ may also be taken in with food. They then bore through the wall of the alimentary canal and reaching the blood stream are carried to the lungs, returning later on to the intestine via the mouth.

Effect of Infestation.

The cattle hookworm is a not uncommon parasite in Queensland and probably is concerned to a certain extent in the general unthriftiness of calves in many coastal areas. The species is responsible for a

considerable loss of blood, and in other countries where it is found is regarded as a very serious parasite, causing symptoms very similar to those already outlined for the large stomach worm.

Treatment and Control.

No tests so far as is known have yet been made with drugs for the removal of the cattle hookworm. Of the many drugs available tetrachlorethylene seems to be the most promising as well as being fairly safe. Doses of 10 cubic centimetres to 30 cubic centimetres are advised. These dosages, to be as safe as possible, should be followed by a purgative (Epsom salts).

The preventive measures outlined for the large stomach worm should also be enforced as far as practicable.

THE LARGE BOWEL WORM (Oesophagostomum radiatum).

PLATE 293.—THE LARGE BOWEL WORM (*Oesophagostomum radiatum*).

Description and Life History.

This species is a whitish worm up to ¾ inch in length inhabiting the large bowel. The life history is very similar to that of the large stomach worm, but in this case the infective larvæ after being taken in by the animal when grazing make their way into the intestines and burrow into the intestine wall. This results in the formation of a small nodule in which the young worm spends portion of its life. Its development in the nodule being completed, the worm then makes its way into the large bowel where it spends the remainder of its existence.

This species is a very common parasite of cattle, and when in numbers is considered to cause unthriftiness, especially in calves.

Control.

There is no treatment available for the removal of the large bowel worm, and the preventive measures advised for the control of the large stomach worm should be practised.

THE LUNG WORM (Dictyocaulus viviparus).

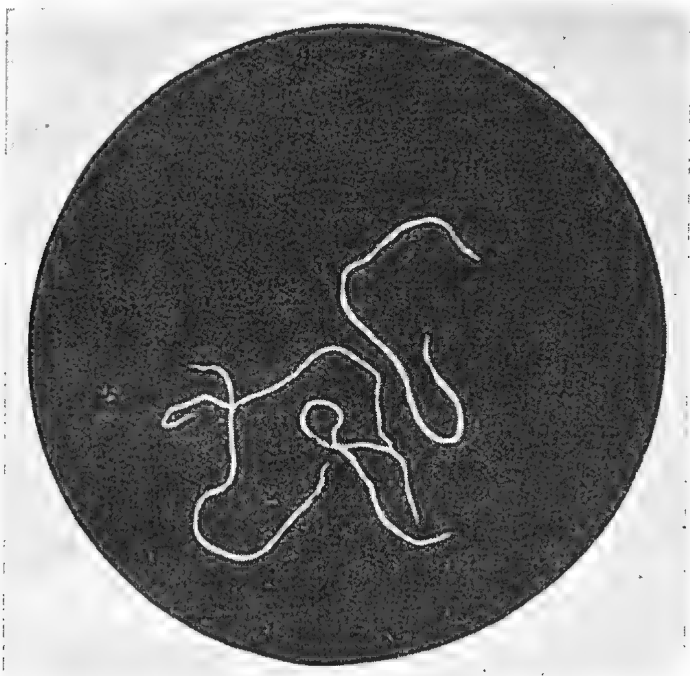

PLATE 294.—THE LUNG WORM (*Dictyocaulus viviparus*).

The lungworm is an elongate slender worm occurring in the air tubes of the lungs. The females may grow up to 3 inches or more in length. The males are smaller and measure $1\frac{1}{2}$ to 2 inches long.

Life History.

The eggs when laid by the female worm contain fully developed embryos and hatch in the lungs. The young larvæ may travel into the mouth, be swallowed, and reach the exterior in the dung, or they may be coughed out in the bronchial secretions.

After a period of development outside the animal they reach the infective stage. They are then taken in by the animal in food or water. Boring through the intestine wall they eventually reach the lungs either in the blood or lymph streams. Once in the lungs the larvæ make their way to the air tubes, where they become mature.

Symptoms of Infestation.

Lungworms are serious among calves and young cattle only. In light infestations no symptoms are observed. When the worms are numerous the calf develops a husky cough. The bunches of worms in the air tubes may interfere with breathing and the animal may exhibit symptoms of suffocation. Large amounts of mucous, sometimes

blood-streaked, may be expelled, and in which bunches of worms may occur.

Treatment and Control.

The following measures, if adopted carefully, should control any outbreak of this parasite:—

1. As the free living stages are favoured by paddocks of a marshy nature, all animals in such paddocks should be removed to high and dry country, and a safe supply of drinking water provided if possible by using troughing.
2. As stomach worms are usually found under the same conditions as lungworms, a bluestone drench by removing any stomach worms will assist the calf to resist the lung worms. This drench consists of 3 to 8 oz. of a solution of ½ lb. of bluestone (fresh) in 3 gallons of water following overnight starvation.
3. Infested animals should have good nutritious food. The greatest factor in treating an infested calf is good nursing.
4. In severe infestations an intertracheal injection of the following formula will be found beneficial, especially if repeated after one week. The injection is made with a sterilised hypodermic syringe between the cartilaginous rings of the windpipe:—Turpentine, 1 drachm; carbolic acid, 10 minims; chloroform, ½ drachm; glycerine, 1 drachm.

THE BEEF NODULE WORM (Onchocerca gibsoni).

PLATE 295.—THE BEEF NODULE WORM (*Onchocerca gibsoni*).

This parasite takes the form of nodules, varying somewhat in shape and size, which occur in the brisket and stifle joint. These

nodules are generally rounded and may measure up to 4 inches in diameter. In the centre of the nodules or worm nests there lies a long threadlike female worm 20 to 56 inches long, with which may be associated one or more males 1½ to 2 inches long.

The nodule itself is constituted of fibrous tissue and is formed by the host tissues as a reaction to the presence of the parasite. Eventually the worms die and undergo calcifiation but the nodule remains.

Effect of Infestation.

The beef nodule worm is exceedingly common and is found in cattle of all ages excepting young calves. The worm does not appear to be harmful in any way to the animals themselves, but as nodule-infested briskets are not permitted entry into the United Kingdom, the loss to the beef industry through the removal of this portion of the carcase is very heavy.

Control.

No control measures for this parasite can be recommended until its life history is known. Other worm parasites closely related to the nodule worm require an intermediate host to complete their life cycle, and in several cases species of "sandflies" fill this roll.

PLATE 296.—SECTION OF BEEF CARCASS COMPETITION, BRISBANE ABATTOIR.

[*Block by courtesy Queensland Meat Industry Board.*

The Wireworm Pest and its Control in Central Queensland Sugar-cane Fields.

By W. A. McDOUGALL, Assistant Entomologist.

LARVÆ of certain genera of the Elateridæ or "Click Beetles," commonly known as wireworms, are capable of causing great damage to cultivated crops, and for a considerable number of years it has been recognised that wireworms are responsible for damage to sugar-cane in certain parts of Queensland. Jarvis (1927 *b*) stated that in 1910 wireworms had been observed to inflict serious damage to young cane planted on alluvial flats at Mackay, and that in the same year this pest occurred freely in Isis Central district, where it was reported to be causing more damage to cane than was being done by any other insect. This writer further (1925 and 1927 *a*) listed a number of possible wireworm control measures. Illingworth (1919) mentioned that there was evidence of wireworm damage in the Mossman district. During the period 1924-30 officers of the Bureau of Sugar Experiment Stations published various reports embodying some field observations, locality records, and recommendations for the control of these pests. Cottrell-Dormer (1924 *b* and *c*) reported damage in low-lying country at Mooliba (near Babinda) and in the Homebush and Eton districts, near Mackay. Writing of wireworms in the Mackay district (1924 *a*) he stated that they do damage mostly during the colder months of the year; it was claimed by some farmers that such damage was worst following a planting of cowpea as a green manure crop. Mungomery (1926) found wireworms attacking cane in the Pialba district, particularly after spring planting, and Bates (1925) reported *Monocrepidius* sp. attacking eyes of setts at Strathdickie and Tawvale, Proserpine mill area, during July and August. In 1928 the attention of Burns (1928 *a*), then Assistant Entomologist at the Mackay Experiment Station, was drawn to a serious wireworm infestation at Te Kowai. Plants were bored into at the ends, and the wireworms were observed to be voracious feeders capable of rapid movement through the soil. Burns (1928 *b*) observed several species* of wireworms in Mackay canefields, and in his annual report for 1929 mention was made of several large infestations at Walkerston, Te Kowai, Farleigh, Habana, and Racecourse. Following further and more serious damage in this area, a rapid survey was carried out by Mungomery, who reported to the Director (1930) that damage appeared to be most severe in low-lying, poorly-drained land which remained wet and cold. The life cycle of the pest was thought to be at least a year or more, and the period of oviposition of the adults a very protracted one.

Although much had been written about wireworms damaging cane in Queensland and their possible control, no serious attempt had been made to investigate the problem thoroughly prior to 1931. In that

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* Specimens at the Mackay Experiment Station labelled by Burns as "Wireworms ex canefields 1928" have been identified as J. sp. *Lacon assus* and *L. variabilis*. All those found damaging cane are of the lastmentioned species.

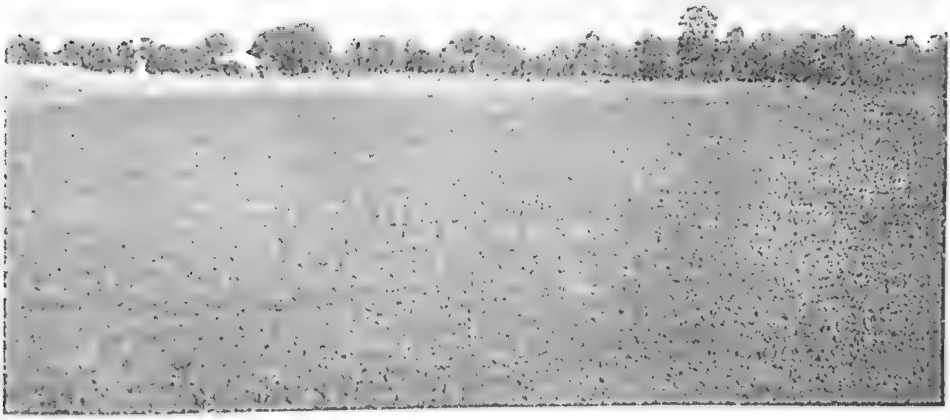

Fig. 1. A field of four acres completely destroyed by wireworms; note an occasional shoot and damaged plants which had been removed when supplying. This was the first planting since about 1917, when a similar strike failure occurred. Swamp country, Sandiford, July, 1933. (Photo. by W. C. Dormer.)

Fig. 2. Poor stand of cane in a low corner of the field; the eyes have been destroyed by wireworms. The planting of this corner always results in a poor strike. Walkerston, 1931.

Fig. 3. A poor stand of cane in a badly drained lower end of a field. The eyes have been destroyed by wireworms. Walkerston, 1931.

Plate 297.

year the investigation of the wireworm problem in the Mackay and Proserpine mill areas was made a major project, since in these areas, more so than in any other Queensland cane district, wireworms are, at times, a serious pest. Certain portions of the work carried out by the writer have already been published—McDougall (1934).

Nature of Wireworm Damage and its Economic Importance.

The wireworm larvæ attack the swollen eyes of cane setts, young shoots, or the underground portions of larger shoots. The damage consists in the eating of only a small tunnel which cuts across the centre of the growing point, thus bringing about the death of the shoot or bud; in some cases a considerable portion of the interior of the buds may be eaten. Examples of damage to growing shoots may be seen in Plate 300, fig. 1. When wireworms are found in the act of eating into buds or shoots, it will be noticed that as a rule a considerable portion of the posterior half of the larva is protruding from the tunnel. In contrast to this mode of attack, the larva of the large moth borer (*Phragmatiphila truncata* Walker) enters a shoot by a small hole, and completely houses itself by eating out the centre for some distance above and/or below the entrance hole level (*see* Plate 300, fig. 2).

When all the eyes and small shoots of a set are attacked no stool results, while when larger shoots are attacked the effect is to produce "dead-hearts" in the primary shoots, the formation of the stool then depending on the formation of secondary shoots. On rare occasions the secondary shoots—in fact, all shoots as they arise—may be destroyed by the pests. The effect of wireworm attack on shoots and eyes may thus result in practically a complete failure of germination throughout the field (Plate 297, fig. 1.) Such complete failures are unusual, however, and as a rule the misses are lightly or heavily distributed throughout the block or are confined to small or large patches or to the lower ends of fields (*see* Plate 297, figs. 2 and 3; Plate 298, figs. 1, 2, and 3).

Damage in the Mackay district is almost exclusively confined to low, badly-drained land. During the past fifteen years considerable areas of this type of country have been planted to cane in the Mackay and Proserpine mill districts, and this has been responsible for the appreciably increased proportion of damaged strikes caused by wireworms. Taking the districts as a whole this proportion is not high, and the majority of the farmers are not troubled by wireworms except, possibly, in an occasional low spot in which a poor strike is considered by many of the farmers to be of little consequence. This fact points to one of the most serious aspects of wireworm damage. If the total damage were more evenly distributed, losses would not be so disturbing, but, unfortunately, there is a small percentage of farms which contain quite appreciable areas of wireworm infested country, and here this pest is most serious.

Losses caused by wireworm depredations consist in the decrease in plant and subsequent ratoon tonnages, and an increase in production costs per ton of all cane harvested in wireworm infested fields. This increased cost may be due to the irregular distribution of the stools in the fields, supplying misses (often two or three times) or even replanting,

Fig. 1. A poor stand of cane on a badly drained lower end of a field. The eyes and young shoots have been destroyed by wireworms. Walkerston, 1931.

Fig. 2. A complete strike failure in a very badly drained depression. The eyes have been destroyed by wireworms. The Lagoons, Mackay, 1932.

Fig. 3. A poor stand of early plant cane in a badly drained depression in the centre of the field. The eyes and young shoots have been destroyed by wireworms. Te Kowai, July, 1933. When planted in 1928 a similar bad strike was obtained. (Photo. by W. C. Dormer.)

Plate 298.

the initial cost of preparing parts of fields which do not yield any returns whatsoever, wasted fertilizer, increased cultivation costs due to the greater weed growth where poor stands occur, or the cost of some unsuccessful methods of wireworm control which may have been tried after the presence of the pests had become evident in the fields. Ratoon crops do not suffer damage from direct wireworm attack.

The Pest Species.

Jarvis (1927 *b*) stated that he had reared *Monocrepidius* adults from larvæ found in the soil about cane roots in the Bundaberg district, and until 1930 this seems to have been, with one exception,* the only rearing work done with wireworm pests from Queensland canefields. It would seem to have been the custom in the past, if naming the pests at all, to refer any wireworms damaging cane anywhere in Queensland to the genus *Monocrepidius*. The first departures from this custom were when Mungomery (1928) stated that *Lacon variabilis* and many *Monocrepidius* species damaged cane in Southern Queensland and when the same author (1930) considered that apparently one species, a *Lacon* species, was responsible for nearly all the wireworm damage reported from the Mackay and Proserpine districts.

During the three years 1931-33 the following Elaterid larvæ were collected at different times from Central Queensland cane fields: *Lacon lateralis* Schw., *Lacon variabilis* Cand., *Lacon assus* Cand., *Lacon humilis* Er., *Heteroderes carinatus* Blbn., *Heteroderes cairnsensis* Blbn., *Agrypnus mastersi* Macl., and several other species whose adults are either not known, or, if known, are unidentified. Included in the last group is *Lacon* "Q" sp. It was found that very nearly all wireworm damage observed during the above period was due to *L. variabilis*.

Specimens of the wireworms found by Mungomery to be damaging cane in the Mackay district were examined and identified as *L. variabilis*.

It has been established that wireworms have been pests in some particular fields in the Mackay district since as early as 1890, and examinations of the damaged areas in these fields during a planting in 1931, 1932, or 1933, showed the pest to be *L. variabilis*. Inspections of damaged areas proved to be those referred to in some of the literature as localities of damage by *Monocrepidius* spp., have shown the pest in these localities to be *L. variabilis*. It seems evident that this species is and has always been the wireworm pest in the Mackay and Proserpine cane fields. Consequently in this paper unless otherwise stated, all discussion will refer to *L. variabilis* and further references to other species of wireworms found in Central Queensland cane fields will be made only when they may be of help in the identification of the various stages of *variabilis* in the field and in the formulating of a control for this pest.

Description of L. variabilis.

The Adult.—The adult "click-beetle" is a uniform dark-brown colour on both upper and lower surfaces. It is moderately flat in shape and shows a considerable variation in size ranging from one-third to one-half inch in length, with a width of about one-fifth inch. The elytra or wing covers appear as possessing a series of parallel ridges which run lengthwise.

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* Mungomery (1927) listed *L. variabilis* amongst the insects reared by him during that year from larvæ to imagines.

The following descriptive information concerning the genus *Lacon* is derived from Elston (1924):—

"The mandibles are bifid or dentate on the inside. The apical segment of the palp is securiform. The antennæ are short: the first segment is large and somewhat bent, the second and third small, the third somewhat shorter than the second, the following are triagular, the last at the apex truncate or emarginate. The elytra are usually punctate-triate or with seriate punctures, the shoulders either rounded or angular, and the epipleuræ more than twice as long as wide. The antennal furrows on the prosternum reach only to the middle. The insects of the genus may be divided into four sections according to the presence or absence of well-defined tarsal furrows on the pro- and metasternum. One section is represented by *L. variabilis*, which is without tarsal furrows on the meta- and prosternum, or, if present on the latter, are so ill-defined as to be almost indiscernible."

Elston found that as the name *variabilis* implies, the species is very variable.

"On some specimens, particularly with the male, the tarsal depression is more or less visible, whilst on others it is entirely absent; the sculpture of the elytra also shows a certain amount of variability, the alternate interstices being more conspicuously elevated on some species than on others."

There is found to be very little variation in the elytral structure of adults reared from larvæ attacking cane or in adults collected in the Mackay and Proserpine canefields. On examining an elytron it will be found that, excluding the lateral ones, the alternate interstices, which are wider and have three rows of hairs instead of two (Plate 303, fig. 4) are nearly always sufficiently elevated to give a general macroscopic appearance of a distinct series of parallel ridges. In specimens from Rockhampton and in a very occasional one collected in Mackay canefields, the alternate interstices are not as conspicuously elevated as in the vast majority of Mackay specimens.

Detailed measurements, in millimetres, of the largest and smallest specimens collected over three years in Central Queensland canefields, are as follows:—

—	Total Length.	Thorax.		After-body.	
		Length.	Width.	Length.	Width.
Largest specimen	14·5	3·9	4·4	9·7	4·7
Smallest specimen ..	8·7	2·4	2·7	5·7	2·8

The Egg.—The egg is opaque to pearly-white in colour, elliptocylindrical in shape, and the ends are broadly rounded and similar. From the measurement of one hundred eggs it is evident that there is little variation in size; the length always approximates very closely to ·58 mm. and the width to ·47 mm., i.e., if placed lengthwise there would be about forty-three eggs to the inch. Under a magnification of 80x the chorion is seen to be quite smooth, and that it is tough is shown by the fact that the eggs are easily handled without any changes in their shape, and that during a considerable period after the hatching of the small larvæ it is difficult to separate the shells from the full eggs.

The Larva.—The active larva or "wireworm" is a worm-like segmented creature, semi-flattened in shape, and, when full-grown, is usually about four-fifths of an inch in length and with a greatest width

of approximately one-eighth of an inch. In general appearance it is pale waxy-yellow with the "head" and forked part of the end segment reddish-brown. The short legs are armed with short brown spines. In the field the larvæ may be recognised by the shape of its end segment as in Plate 299, fig. 2B, and Plate 304.

The greater part of the dorsal and ventral surfaces is pale waxy yellow with the narrower lateral areas a lighter shade. With the exception of the nasale and mandibles, which are very dark brown to black, the head and the pronotum are reddish-brown. The four prongs of the two terminal processes and the five tooth-like structures on each lateral margin of the flattened dorsal portion of the ninth abdominal segment are dark reddish-brown. The spiracles are not conspicuous. The nasale is tridentate, the processes being of equal lengths (Plate 303). The "pseudopodium" (anal segment) is armed with a strong ascending hook (Plate 304). There is one conspicuous variation in larval setation; conspicuous because it concerns the flattened dorsal surface of the ninth abdominal segment. There, the presence of two tuberculate hairs situated at about the beginning of the distal third is constant. Midway between these two hairs and the anterior margin two smaller hairs will be noticed in Plate 299, fig. 2B. In this position as many as five hairs may be present, or none at all.

The following is an example of a detailed measurement, in millimetres, of a full grown mobile larva:—Total length, 20.0; head capsule, length 2.0, width 2.0; prothorax, length 2.0, anterior width 2.1, posterior width 2.5; other two thoracic segments, length of each 1.0, width of each 2.8; length of each of first eight abdominal segments 1.4, width of first 3.0, width of fifth 3.2, width of eighth 2.9; ninth abdominal segment, length 2.4, greatest width 1.9.

The Pupa.—When first formed the pupa is opaque white and, except that the abdomen is slightly longer, very much resembles the adult beetle into which it will change in both shape and size.

The pupa is microscopically spinose. There are two fleshy thorn-like structures or spines on the anterior border of the prothorax above the eye spots. These point upwards, whereas similar ones on the lateral angles of the much broadened posterior angles point upwards and outwards. The spines in the angles formed by the dorsal median line and the posterior border of the prothorax are very small. The bifid nature of the adult mandible is early discernible in the pupa. The antennæ, of similar form to those of the adult, lie along the margin of the thorax on the ventral side and reach to the posterior angles. There are nine abdominal segments. The ninth terminates dorsally in two closely placed fleshy spines covered with brown barbs. At the base of each spine there is a much smaller spine. During early life the wing cases reach on to one quarter of the venter of the fourth abdominal segment and the third pair of legs on to one quarter of the fifth. Later—i.e., during the last four days of pupal life—there are considerable visible alterations, including a darkening in colour; the tips of the mandibles are plainly visible as also are the antennal and tarsal segments. The edges of the antennal furrows become pencilled in brown, and the relative position of tips of the wing cases, the posterior legs, and the abdominal segments change very appreciably. The contents of the eighth and ninth abdominal segments retreat into the adjacent segments leaving an empty case. The shape of the seventh abdominal sternum of the pupa is very similar to that of the seventh body segment (actually the fifth visible) of the adult. In the pupa all the abdominal terga and sterna can be seen.

Distribution.

According to Elston (1924) *L. variabilis* is commonly distributed over the whole of Australia and Tasmania. However, with the exception of the records of damage to cane in Central and Southern Queensland it has not otherwise been recorded as a pest. With the exception of five adult specimens labelled "Rockhampton" in the Queensland Museum, a few adults collected in the Bundaberg district, and specimens that had been received from Mackay during the past four years, no adults or

larvæ of this species could be found in any of the Queensland collections of Coleoptera examined. These included those of the Queensland Museum, Department of Agriculture and Stock, at Brisbane, the University of Queensland, and of the Sugar Experiment Stations at Meringa and Bundaberg. Wireworms found by Mr. Mungomery, during the past year, to be damaging cane in the Bundaberg district were reared to adults at Mackay and other specimens collected in the past from southern canefields were examined; none of these is *L. variabilis.* However, Mr. Mungomery has informed the writer that *L. variabilis* larvæ have been found actually damaging cane setts in the Pialba district; this occurrence is responsible for the recording of this species as a pest of cane in Southern Queensland.

In 1931 two species of wireworms reported to be damaging cane setts at Mossman, North Queensland, were forwarded to the writer for examination. The smaller species, one of the cylindrical type of Elaterid larva, was considered by the observer to be the more serious pest; what proved to be the adult of this species could be found in the cane in circumstances similar to those mentioned by Illingworth (1919). The two specimens of the second species could not be distinguished from the sixth larval instar of *L. variabilis.* Moreover, it seems that wireworm infestations in the Mossman district occur under conditions similar in many respects to those concerned with the habits of and damage by *L. variabilis* in the Central Queensland fields.

Other Insects which may be mistaken for Lacon variabilis.

There is but one commonly seen Elaterid adult or "click-beetle" in the Mackay and Proserpine districts which more or less closely resembles *L. variabilis* (*see* Plate 299, fig. 1). This is *Lacon humilis* Er. As will be noticed in Table II. (page 703), *L. humilis* is attracted by light, whilst *L. variabilis* is not. *L. humilis* is darker in colour than *L. variabilis* and there are no apparent ridges on the wing covers.

(When the central portion of an elytron of *L. humilis* is examined it will be seen that the interstices are all of similar width; the clothing is similarly arranged on each, and there is no outstanding elevation of any of them (see Plate 303).)

Dystalica mackayensis Carter (Plate 303) is very plentiful and noticeable in Central Queensland canefields. If wireworm damage is particularly heavy in any field or district, farmers often form the opinion that this beetle is the adult of the wireworm. *D. mackayensis* is not a "click-beetle," being a member of the family Tenebrionidæ and its larvæ are quite harmless to cane.

In the larval or wireworm stage many different Elaterid species, which may have quite different habits, very closely resemble one another, but so far as those in Central Queensland canefields are concerned, it is necessary that the differences between two species only be known. These are *Lacon variabilis* (the lowland wireworm) and *Heteroderes carinatus* (the highland wireworm). They are very similar in colouring and general shape, but in the field they may be distinguished by the differences in the shapes of their end segments as shown in Plate 299, fig. 2, and Plate 304.

(The nasale of *H. carinatus* is pentadentate, the processes being of equal length (Plate 303). There is no strong hook on the pseudopodium (Plate 304).)

Heteroderes carinatus, although quite plentiful in well-drained fields in the Mackay district, has never been known to seriously damage cane.

Fig. 1. Adults of A: *Lacon variabilis* Candige, x 5. B: *Lacon humilis* Er. x 5.

Fig. 2. Dorsal views of full-grown larvæ of A: *Heteroderes carinatus* Blackburn, x 4. B: *Lacon variabilis* Candige, x 4.

Plate 299.

The carnivorous larvæ of the carab, *Gnathaphanus pulcher* Dej., is generally distributed in many fields and may be present in large numbers in some situations. With its brown head and very pale-yellow to white abdomen it is sometimes mistaken for a wireworm, but it should be easily distinguished from any of the latter by the greater size of its head in proportion to its body, the much softer abdomen, and the presence of two spine-like strucutres (urogomphi) near its posterior end.

The three false wireworms most common in Mackay and Proserpine canefields are the larvæ of the Tenebrionid, *Dystalica mackayensis,* and of the Cistelids, *Hybrenia elongata* Macl. and *Dimorphochilus pascoei* Macl. The latter two when seen in the field are much larger than most of the local semi-flattened wireworms. All resemble the cylindrical type of wireworms (nône of which damage cane in ploughable canefields in Central Queensland) more than the semi-flattened type of which *L. variabilis* is a member. The false wireworms possesses a distinct lamrum whereas wireworms and other Elaterid larvæ do not.

Insect Damage which resembles that caused by Wireworms to Cane.

In Central Queensland cane areas there are three insects that may cause damage to cane which superficially resemble that caused by wireworms. These are a small black beetle *Pentodon australis* Blbn.* (Plate 300), the caterpillar of the large moth borer (*Phragmatiphila truncata* Wâlker), and small white grubs of *Rhyparida* species. Of these *Pentodon australis* is of the most importance, and like the wireworm it causes "dead-hearts" in growing shoots and eats the eyes of setts. This damage may be effected in either high or low land, and damage by Pentodon in high land in which larvæ of *H. carinatus* have been observed, is often debited to wireworms.

When a wireworm attacks a shoot the hole is surrounded by small amounts of fibrous material (Plate 300, fig. 1). On the other hand the Pentodon beetle, which is larger than the wireworm and a much grosser feeder, in its attack on the underground portions of the shoots, makes much larger holes, at the edges of which are considerable masses of frayed fibrous material (Plate 300, fig. 3)—a beetle in the act of feeding is shown on the extreme right). When the Pentodon beetle attacks the eye of a sett it does not tunnel to the centre but gouges it out completely. Damage to strikes by the larvæ or grubs of the Pentodon beetle is more common in early than in late plantings; these grubs chiefly damage eyes and setts by eating out large cavities.

Plate 300, fig. 2, shows the small, neat holes in shoots caused by the large moth borer. This insect does not attack eyes of setts. Attacks by *Rhyparida* spp., although sometimes severe, are comparatively rare.

Habits and Characteristics of Lacon variabilis.

Few eggs or first-stage larvæ have been seen in the field. Washing and sieving (after Shirck (1930)) of soil samples from localities where

* According to C. E. Chadwick, Eltham, N.S.W. (in a communication dated 25th July, 1933) this species was described by Olliff under the name *Heteronychus vulgivagus,* and in the South Australian Museum collection all specimens of this species, including a cotype of *Pentodon australis* Blbn., stand under the name *Meanastes vulgivagus* Olliff. The name *P. australis* is used in this publication for the reasons: (*a*) up to the present no published accounts of the synonymy of this species have been found; (*b*) for many years the insect has been widely known under this name to cane farmers in Queensland and New South Wales.

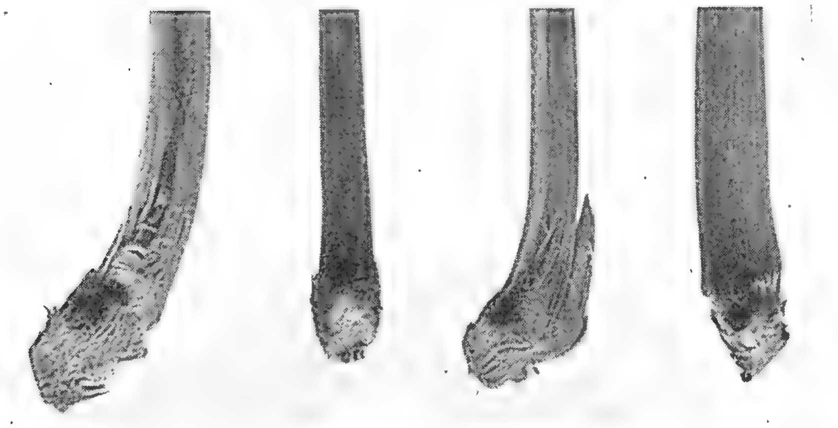

Fig. 1. Wireworm damage. Note that tunnel does not extend beyond the centre of the shoot nor above or below the growing point.

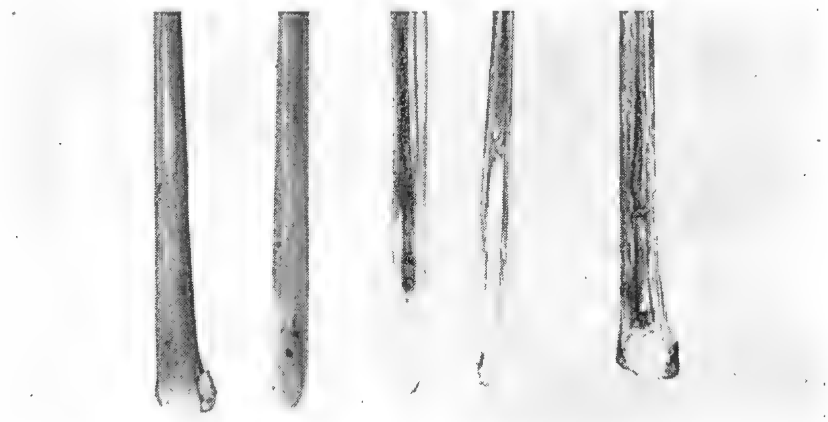

Fig. 2. Underground portion of cane shoots attacked by *Phragmatiphila truncata* Walker.

Fig. 3. Underground portions of cane shoots damaged by *Heteronychus arator* F.

PLATE 300.

adults were known to have been present four or five weeks prior to the date of sampling, gave very poor yields. In the laboratory, gravid female adults, caged under conditions made to resemble as nearly as possible those which would most likely be encountered by them in the field, usually deposit eggs either singly on the soil surface or in batches in crevices at a depth not exceeding two inches. The eggs are not covered by any secretion, and when laid in batches are not connected in any way. No egg chambers are constructed. Observed first batches of eggs deposited by an adult have contained from two to seventeen eggs, but usually ten to fifteen, while later batches deposited by the same adult have consisted of as many as twenty-three eggs or as few as two. Table I. is a sample of a series of the recorded observations on the number of eggs deposited (and dates of deposition) by thirteen beetles during the 1931-32 summer, and twenty-three beetles during the summer of 1932-33. The maximum number of eggs deposited by any one female was thirty-six, the minimum two, and the mean for the thirty-six beetles was twenty-three.

TABLE I.

Egg Deposition as Recorded from Observations on 36 Caged Females.

Lab. No. of Female.	Number of Eggs Deposited.	Date of Deposition.	Remarks.
A 1 .. (confined with 2♀♀)	15 11	8–1–32 3–2–33	On 24–2–32 female still alive; dissection showed 65 well-developed eggs in egg-tubes
A 2 .. (with 2♀♀)	13 23	10–1–32 28–1–32	On 24–2–32 female still alive; dissection showed 59 well-developed eggs in egg-tubes
A 7 .. (with 1♀)	4 7 15	3–12–31 1–2–32 3–2–32	
A 5 .. (with 3♀♀)	10 2	20–11–32 5–12–32	All females alive on 29–3–33 with well-developed eggs in egg-tubes
A 8 .. (with 1♀)	12 19	9–12–32 18–12–32	
A 9 .. (with 4♀♀)	12 10	7–12–32 16–12–32	

The eggs have withstood immersion in water for a period as long as five days, and young have hatched out from eggs exposed to a soil environment ranging from moderately dry to free water present. The young larvæ emerge from the eggs through small holes eaten in the shells. Dispersion through the upper two or three inches of soil quickly follows and, at this stage in larval life, feeding largely consists in the ingestion of soil. The average length of the newly-hatched larvæ is 2·1 mm. and the width ·27 mm., the widest parts being the head capsule and the prothorax. Towards the end of the first larval stadium the length may be as great as 3·38 mm. and the width ·43 mm., the abdominal segments being then the widest parts.

During a moult the skin usually splits along the median dorsal line of the thorax only; sometimes the head capsule and the anterior abdominal segments are included in the splitting. The thoracic segments first emerge through the split and are followed by the head and abdomen. The pulling of the abdomen through the unsplit portion of the moulted skin or exuvium causes a certain amount of telescoping of the exuvial segments; the result is that the moulted skin appears as a distinct head capsule and a distinct ninth abdominal segment connected by a mass of telescoped intermediate segments. An exuvium of this type* is comparatively compact and does not break up very quickly in loose soil; such exuviæ from the larger instars are often found complete in the field.

After a number of ecdyses, or moults, pupation takes place in earthen cells at a soil depth which depends upon the disposition of the moisture in the soil at the time when the mobile larvæ assume a torpid prepupal state. This change of state invariably takes place in the top two inches of visibly moist soil. If the weather has been showery the pupæ will be found within an inch of the soil surface, whilst following dry times, pupæ have been collected at soil depths as great as seven inches.

Adults are seldom seen in the field unless special search is made for them in suitable localities at certain times of the year. After light showers of as little as ten points, or after heavy rains in November or December, they may be found in their greatest numbers behind the lower leaf sheaths of cane growing in depressions or in any other low-lying part of a canefield where wireworm damage was evident during germination. In these low-lying areas adults may also be found under clods, at the base of grass clumps, or under any debris which may be present. Often adults of other Elaterid species and false wireworms will be found along with *L. variabilis.* Under one small plant in November, 1931, there were found as adults, nineteen individuals of *L. variabilis,* three of *L. assus,* numerous *H. cairnsensis,* and many *Dystalica mackayensis* Carter, together with larvæ and a few pupæ of the last-mentioned. Occasionally as many as fifteen *L. variabilis* adults have been collected from behind one leaf sheath, but usually not more than five will be so found. When disturbed the beetles drop and remain inert for some time. Structurally they are capable of strong flight but are seldom seen in flight. During three years' observations less than twenty adults have been seen in the field other than under the various previously-mentioned covers. These observations were made during all hours from 4 a.m. to 12 p.m. After suitable rains on one occasion, fifteen adults were taken after flight from cane leaves at 9 p.m.; fairly heavy rain had been experienced during the day.

Migration and Initial Infestation of Fields.

There seems to be no doubt that the adults will in time migrate from their native habitat (i.e., swampy grass lands), and slowly invade

* During ecdyses of the cylindrical type of wireworm, and of the Tenebrionoid larvæ studied, the splitting of the skin along the mid-dorsal line is not confined to the thorax but is continued along the first seven or eight abdominal segments as well. Exuviæ of these larvæ quickly fall to pieces.

any part of a field where structural work such as the building of a railway, road, or tramline, or other cause has made the drainage insufficient. It appears, however, that migration of adults from one locality to another in badly-drained cultivated country is even slower, but once the species is present in a cultivated fields its population density may increase. This is in marked contrast to the behaviour of several other *Lacon* species, such as *L. humilis, L. lateralis,* and "Q" species; larvæ of the first-mentioned two species are seldom found in cultivated fields although their adults are sometimes there. *Lacon* "Q" sp., together with *L. variabilis,* may be found damaging strikes in new, badly-drained country which had been broken up for the first time during the early part of the year.

In future plantings in this type of country it will be found that, when the season is suitable, *L. variabilis* will be present in larger numbers than before, whilst *Lacon "Q"* sp. larvæ will have practically completely disappeared. In the laboratory it is not difficult to induce *L. variabilis* to oviposit in fairly loose soil, but when gravid females of the other three mentioned *Lacon* species are confined under similar conditions only a few eggs are obtained. All these species will, however, lay eggs in flower pots in which the soil has been pressed down and left until grass has grown in them.

Reaction of Adults to Light.

White to yellowish light does not attract *L. variabilis* adults and this species is very seldom found amongst the "click-beetles" which come to light in houses during the wet season or after the early summer rains. Using an acetylene light and white sheet, attempts to collect Elateridæ were made in several localities at different times during October-February periods. In Table II. are found details of some of the collections.

TABLE II.

Results of Collecting at Lights, using an Aceytlene Light placed on a White Sheet. Laboratory Number of Collection and Number of Specimens are Given, together with Time and Date.

Species.	No. 1. 4th Nov., 1931, 8 p.m. to 9 p.m.	No. 3. 19th Nov., 1931. 9 p.m. to 10 p.m.	No. 5. 7th Nov., 1931. 9 p.m. to 10 p.m.	No. 10. 13th Nov., 1933. 8.30 p.m. to 10 p.m.
L. assus	7	52	23	..
L. humilis	..	..	98	15
L. variabilis	..	..	..	2
L. lateralis	..	..	5	35
H. carinatus	..	3	..	26
H. cairnsensis	..	37	..	..
Other Elateridæ	..	..	3	1

It was whilst making collection No. 3 in a field of plant cane which had been slightly damaged by wireworms (this field was bedded up

during the final ploughing), that *variabilis* adults were seen on cane leaves. No. 5 was made in a low, wet scrub following heavy rain during the day and No. 10 in a well-drained stock paddock in very close proximity to a depression in a cultivated field where *variabilis* adults were known to be present. On some occasions, when collecting with lights in a wireworm-infested field, the lower leaf sheaths of cane have been bent down to expose the beetles but none came to the lights. If adults are exposed to light during the day time they may fall to the ground, but in any case, after remaining inert for a short period they seek shelter under any available cover as quickly as their comparatively sluggish movements wil allow.

Adults of the *Heteroderes* species move much more quickly than do those of the *Lacon* species studied; also the former sometimes take wing when disturbed. This shelter seeking is not wholly caused by heat from the sun, as it also happens in cool, shady situations.

Feeding Habits of Adults.

The adult stage of *L. variabilis* is not directly injurious to cane. In the laboratory it was found that females bred from larvæ would not oviposit until after very light feeding, and potato tuber was provided for them. It is thought that, in the field, the softer underground portions of plants are their chief source of food.

Distribution of Larvæ in the Fields.

As previously stated the larvæ of this species are confined almost exclusively to badly-drained country or parts of fields. The soil in most of these situations is from 9 to 14 inches in depth, light in colour, poor to fair in quality, and with an impervious clay subsoil. However, provided drainage is bad, soil type seems to be of little consequence in so far as *L. variabilis* habitation is concerned. (Note briefly Table III.*) These wireworms are present in the darker flood country at Proserpine, in "glue-pot," and during some seasons strikes in excellent alluvial flats with several feet of soil over gravel may show "wireworm" misses here and there in the bottom of depressions.

Distribution of Larvæ in the Soil.

First-stage larvæ seldom leave the top 2 or 3 inches of soil. The other larval instars have been found at soil depths depending upon soil moisture conditions at the times of examination. When fork hoeing, or supplying after rain (also after heavy dews in very low, wet country) many larvæ are to be found within an inch of the soil surface, whilst after a spell of very dry weather the older larvæ, if in the mobile state, descend to immediately above the clay. The movement of larvæ in the soil, according to moisture distribution, has resulted, on occasions, in rather spectacular effects. It has happened that some fields known

* At one time some attention was paid to the water-holding capacity of the soils. Later during this wireworm investigation, but before complete mechanical analyses of the soils were done, it was considered unnecessary to continue with the project. The moisture equivalents and sticky points observed are given in this table.

to be inhabited by a considerable *L. variabilis* larval population had been planted when the soil moisture had been very low. The results were good showings of primary shoots. At this stage a shower of rain was experienced. The larvæ came up to the top 2 or 3 inches of moist soil and, as this moisture quickly disappeared they descended. During this movement of the larvæ they came into contact with primary shoots &c., with the result that within three days following the shower fully 70 per cent. of the originally healthy primary shoots showed "dead-hearts."

TABLE III.

RELATIONSHIP OF DENSITY OF LARVAL POPULATION TO DRAINAGE, PERCENTAGE ORGANIC MATTER, SOIL TYPE, AND LOCATION.

No. of Soil Sample.	Farm.	Moisture Equiv. (30 g. per 30 min.)	Sticky Point.	Percentage organic material.	Soil Type and Location.	Density of Larval Population.
		%	%	%		
1	A	30·45	34·84	5·2	Wash in a water-course planted to cane	Large in suitable seasons, bad strikes result
2	A	25·76	29·18	4·2	In a shallow depression	Very much smaller than No. 1
3	A	35·25	35·76	5·4	In hollow, badly drained	Large in suitable seasons, bad strikes result
4	A	16·55	22·21	3·8	Dark, rather sandy, high well-drained land	No wireworm damage; no *variabilis* larvæ ever found in this country
5	A	31·75	34·20	5·0	In a depression	Similar to No. 2
6	B	16·98	29·37	1·0	Very low, greyish	In suitable seasons a very large population is present; extensive damage
7	B	22·07	29·80	2·8	Depression in higher land	Similar to Nos. 2 and 5
8	B	19·69	29·48	2·0	High land, light	*Variabilis* larvæ not present
9	B	15·55	25·11	2·4	High land, darker than No. 8	*Variabilis* larvæ not present
10	C	15·21	20·00	0·9	Low, light coloured	In suitable seasons a very large population is present; extensive damage
11	C	15·10	20·90	1·9	From same field as No. 10; higher part	Very few *variabilis* larvæ present; no damage
12	C	18·55	19·33	1·3	Low	In suitable seasons a very large population is present; extensive damage
13	C	9·33	17·19	1·4	Sandy ridge in same field as No. 12	No *variabilis* larvæ found on this ridge
14	D	27·86	32·04	4·6	Good river bank soil, well drained	No *variabilis* larvæ found in this country
15	D	28·15	36·00	5·2	Similar to No. 14, but nearer old lagoon	Similar to No. 14
16	D	35·23	47·1	4·4	On slope to old lagoon, much darker than No. 15	In some seasons the population is large enough to cause scattered damage
17	D	38·90	49·3	3 2	At bottom of old lagoon, very dark, badly drained	In most seasons population is very large and strikes are complete failures

On one occasion when making inspections in a field where several trash-bound stools of cane were growing, it was seen that all the soft

eyes amongst the damp trash to a height of 6 inches above ground level had been damaged by wireworms. In three instances a *Lacon variabilis* larva was found in an eye.

No larvæ have been found to enter the clay subsoil although this point has been investigated in suitable localities on a number of occasions. In the laboratory a series of drain pipes were filled with soil and clay in a manner such as to simulate natural field conditions as nearly as possible. Six half to full-grown *variabilis* larvæ were placed in each pipe and a glass tube was let down to a different depth in each of the pipes. The soil and clay were allowed to dry out slowly, except near the ends of the glass tubes down which small volumes of water were poured periodically. Invariably the larvæ, if mobile, were found in the small amounts of damp soil near the ends of the glass tubes which did not enter clay. In the pipes where only the top portion of the clay and the soil immediately above it were slightly damp the larvæ were found in the damp soil only. Where the top portion of the clay and all the soil had very nearly dried out the mobile larvæ were found scattered in the soil.

Food and Feeding Habits of Larvæ of L. variabilis.

The larvæ ingest soil, eat into the soft and distended eyes of setts and the sides of the underground portions of cane shoots, and burrow into the ends of the setts themselves. When soil has been the chief food the straight alimentary canal shows through the integument as a dark line. The eyes of setts are not attacked until they become swollen and soft. The softer rind of top plants, the root bands, root eyes, and rootlets* sometimes show the results of *L. variabilis* feeding. Sliced potato tuber and sprouting seeds of corn and wheat have been successfully used as food for larvæ during rearing work in the laboratory. Attempts to persuade larvæ to attack whole potato† tubers always failed; when this material is used as food the larvæ will burrow into the cut surface only.

As is usual with many wireworm species when a number of *L. variabilis* larvæ are confined together in a small amount of soil cannibalistic tendencies are shown. Even second instars have been observed feeding on the internals of their fellows of somewhat similar size. The older larvæ, when in captivity, will also attack small larvæ of the *Scarabæidæ* and of the *Asilidæ*.

The larvæ are voracious but, normally, feeding‡ is not a continuous process throughout larval life. Under conditions such as the presence

* Wireworm feeding on rootlets and roots has no appreciable effect on cane under any climatic conditions in Central Queensland.

† Wireworm damage to cane has evidently made such an impression in the Mackay district that these pests are thought by many persons to damage locally grown potatoes, beans, and many other plants. In every case investigated the Potato Moth (*Phthorimæa operculella* Zel.) was responsible for all damage to potatoes, and the Bean Fly (*Agromyzia phaseoli* Coq.) was the cause of damage to beans. The damage to potatoes was usually observed during storage.

‡ More detailed accounts of larval feeding, larval instars and their stadia, and the relationship between larval growth and the moisture and temperature of larval habitat are given in a previous publication (McDougall, 1934).

of vegetable material and suitable soil moisture, it is limited to short periods immediately following each larval moult.

Response of Larvæ to Extremes in Environmental Conditions.

Any of the larval instars can withstand excessively wet soil environments for considerable periods. In the laboratory larvæ have been kept for five months in soil with moisture content well above its sticky point. Larvæ have been found in cultivated fields on which water has been lying for as long as four weeks; such larvæ are always in a healthy condition.

During rearing work it was found that the early larval instars require excessive soil moisture for their existence at summer temperature for Mackay. The smaller instars died if the moisture of the soil was allowed to fall to a point lower than about three-quarters of its sticky point. Half to full-grown larvæ, however, have been kept alive for six months in soil (sticky point 29·8) which dropped during that period from a moisture content of 15·7 per cent. to 5·1 per cent. (calculated on oven-dry weight of soil). Absence of vegetable food has very little serious effect on any of the larval instars other than retarding the normal rate of development. Larvæ have been reared through as many as four instars in pots of fresh soil, moist or wet as required, without addition of other food at any time. A parallel series of larvæ was reared in similar pots, and to these latter small pieces of potato were added at different times. Provided no larva had moulted since confinement and had not progressed as far as the immobile pre-ecdysal state, the tuber was always eaten into within a day of its being supplied.

Life History.*

The species *Lacon variabilis* has one main generation a year; the adults appear from late October to early February, but in greatest numbers in November and early December. Within a fortnight after their emergence from the soil, adults may no longer be found under the various covers as they have by then disappeared into crevices of the soil; the depth to which they penetrate very seldom exceeds 3 inches. At about three to four weeks after the emergence of the females the first batches of eggs are deposited. In the laboratory female adults have been kept alive in pots of damp soil for as long as six months and in glass tubes without soil or food for three weeks but field observations indicate that the life of a female adult under natural conditions seldom exceeds seven weeks. It has been found to be more difficult to keep males alive in captivity for more than four weeks. When adults of both sexes which have been reared from pupæ were confined in pots of damp soil, the males die at or just after the time when the first batches of eggs were laid. The egg stage usually occupies eight days, occasionally seven or nine, and rarely ten. There are eight larval instars and, under suitable conditions, the mean duration in days for each of the stadia was, from first to eighth, 9·5, 14·9, 18·9, 20·2, 28·2, 32·8, 38·2, and 152·0,

* More detailed accounts of larval feeding, larval instars and their stadia, and the relationship between larval growth and the moisture and temperature of larval habitat are given in a previous publication (McDougall, 1934).

respectively. Each stadium is found to be varied by the absence or presence of vegetable food and by soil moisture fluctuations due to the changes in weather conditions. The pupal stage occupies from thirteen to sixteen days, usually fourteen days.

Although of very little economic importance there is a small percentage of the *L. variabilis* population which exhibits a two-generation a year life cycle. From eggs deposited during the period November to January there arise a few larvæ which pupate during the following March or April. Females from the April-March pupation have been kept alive in the laboratory until the following February, but attempts to induce some of them to oviposit at such a late stage of their unnatural existence failed. Intensive search for adults has been made in suitable localities in fields during late June to September, but since none has been found, these autumn adults evidently live no longer, under natural conditions than do those which emerge during early and mid-summer. Some autumn adults occasionally oviposit under field conditions and a few of their progeny become imagines in the following summer. When the stadia of the larvæ which become adults in autumn are compared with those of larvæ which take around three hundred days to complete their larval life a shortening of some is evident. The seventh and eighth are greatly reduced whilst many of the others also experience some reduction. The earlier stadia of larvæ from autumn adults are considerably lengthened at the expense of a shortening of the later ones.

Some of the larvæ of both of the short-timed generations pupate after passing through only six larval stadia. However, the majority that ultimately give rise to adults have the normal number of larval instars.

Control.

Much has been written about the control of wireworms* in many parts of the world, but as remarked by Graf (1914) "probably no other insects have had more remedies tried for their control and with less success." As *L. variabilis* has been a pest to cane in Central Queensland mill areas for many years, it is but to be expected that a number of the remedies referred to above have been tried out by farmers with varying results. Also several field observations have become the bases of hypotheses offered as help in arriving at a successful solution of the problem under discussion. During the present investigation it was considered necessary to undertake some work along the lines suggested by previous recommendations as well as following what is now generally accepted as a standard method of attacking the problem of controlling a wireworm pest of a crop such as sugar-cane. In some instances these two parts of the project overlapped. Methods of control are discussed under the three headings of Biological, Chemical, and Mechanical. The methods which are advocated for the control of this pest under general farm conditions are set out on page 725.

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* C. A. Thomas (1930) has reviewed the literature on the control of wireworms up till July, 1930; an excellent bibliography of the more important publications is appended to this review.

Plate 301.

Views of "wireworm" fields, three to four days after heavy rain during a wet season. (Photos. by F. E. M. Clarkson.)

Biological Methods.

No parasites or predators of the larval, pupal, and adult stages of *L. variabilis* which could be considered to be of any economic importance have been found. Up to the present the egg is the only stage which has not been intensively studied in the field. The entomologists of the Experiment Station of the Hawaiian Sugar Planters' Association have also searched unsuccessfully for natural enemies of wireworms in some Queensland canefields. The fungi which are sometimes found on pupæ, adults and larvæ in the rearing pots or on pupæ in the field, are considered to be merely saprophytic. Mites, even when present in moderately large numbers, have no apparent effect on larvæ kept in captivity or on adults in the field. It is interesting to record, however, that dissections made during November to January of the somewhat toad-like frog *Phractops* (*Chiroletes*) *australis* Gray, showed *L. variabilis* adults along with several other insects, amongst the contents of the alimentary canal.

Chemical Methods.

All of the chemical methods tried have been directed against the larval stage of *L. variabilis.* It was early found that positive evidence derived from the use of poisons against wireworms in tins of soil in the laboratory was of little value when the experiments were repeated in the field. The experimental results here given concerning chemical methods are, unless otherwise specifically mentioned, from small field plots put out with the necessary checks in suitable localities only during early planting (March-April) or its immediate replanting. Plots put out during late plantings (July-August) were often very unsatisfactory. After taking into consideration larval feeding habits and larval stadia this could be expected (see "Times of Planting," p. 718).

The criterion which was taken as showing the success or otherwise of any poison was the amount of damage to eyes of setts and shoots. Four methods of applying the different poisons (cyanides excepted) were used:—

1. Dipping or dusting setts.
2. Placing poisons in drills with the setts.
3. Incorporating the poison with the soil surrounding the setts at the time of planting.
4. Introducing the poison into the soil close to the setts at a time when it was considered that the eyes were approaching a condition suitable for wireworm attack.

Table IV. gives results of most of the poison experiments; each has been duplicated in two different fields.

TABLE IV.

Results of Small Field Trials with Chemicals Against *L. variabilis* Larvæ.

Chemical.	Dosage.	Method of application.	Results. (Number of eyes and shoots destroyed by the larva.)	
			Check Plots.	Treated Plots.
Lead Arsenate	10% solution ..	No. 1	14 out of 15 ..	13 out of 17
Mixture of chopped grass, sodium arsenite (1 lb.) and molasses (8 lb. in 10 gallons of water	50 lb. of arsenite per acre	No. 2	19 out of 30 ..	22 out of 30
Paris green	200 lb. per acre ..	No. 1	23 out of 30 ..	20 out of 29
	200 lb. per acre ..	No. 3	25 out of 30 ..	28 out of 35
Sulphur	540 lb. per acre ..	No. 3	31 out of 31 ..	27 out of 28
R.V. 4 Soil Cleanser (33% free sulphur, 30% polysulphides and hyposulphite	680 lb. per acre ..	No. 3	31 out of 31 ..	28 out of 33
Slaked lime	510 lb. per acre ..	No. 1	19 out of 30 ..	23 out of 29
	1,000 lb. per acre ..	No. 2	19 out of 30 ..	17 out of 27
	2,000 lb. per acre ..	No. 3	19 out of 30 ..	15 out of 31
Naphthalene and slaked lime..	400 lb. per acre of each ingredient	No. 2	19 out of 30 ..	17 out of 30
Naphthalene	800 lb. per acre (400 lb. each application)	Nos. 3 and 4 combined	14 out of 15 ..	15 out of 20
	600 lb. per acre* (300 lb. each application)	Nos. 3 and 4 combined	5 out of 20 ..	2 out of 23
Naphthalene (1 oz.) Carbon bisulphide (3 fluid oz.) and soap [after Krauss (1931)]	2 pints of 10 % solution per nine feet of drill†	No. 4	31 out of 31 ..	3 out of 3‡
Carbon bisulphide	350 lb. per acre ..	No. 4	19 out of 35 ..	16 out of 24‡
Paradichlorbenzene and CS_2 ..	300 lb. per acre ..	No. 4	19 out of 35 ..	14 out of 23‡
Paradichlorbenzene	680 lb. per acre ..	No. 2	23 out of 30 ..	24 out of 33
	680 lb. per acre ..	No. 3	23 out of 30 ..	19 out of 30
Paradichlorbenzene and slaked lime	680 lb. P.D.B. and 510 lb. lime per acre	No. 3	14 out of 15 ..	12 out of 15
Orthodichlorbenzene	600 lb. per acre ..	No. 4	25 out of 30 ..	9 out of 11‡
Mustard oil and water. (50 ml. of oil made up to 500 ml.)	One litre per chain of drill at each application†	Nos. 2 and 4 combined	31 out of 31 ..	2 out of 2‡
25% Kerosene emulsion ..	1 litre per half chain of drill	No. 4	25 out of 30 ..	3 out of 4‡

* A late plant plot.

† 147 running chains of drill per acre.

‡ Only eyes not damaged by chemicals were counted.

Kerosene, orthodichlorbenzene, and mustard oil were found to kill sett eyes on contact and, when using carbon bisulphide, it was found necessary to be careful so as not to damage the eyes.

To the above list of poisons which were found to be ineffective in controlling *L. variabilis* when applied by the different methods as indicated, borax and sodium fluosilicate may be added. A chlorpicrin plot was put out during a late plant; both the results of the plot and

methods of handling this fumigant were unsatisfactory. Mention of a laboratory experiment with Paris Green may be of interest. The cut surfaces of twelve pieces of potato tuber were thoroughly coated with Paris Green, but on six of the pieces so treated small areas of the poisoned surface were well cleaned. Each of the twelve pieces of tuber was then placed in a pot containing damp soil and three-quarters grown *L. variabilis* larvæ which had just moulted. It was found that the thoroughly-protected food supply had not been touched, whereas of the other six pieces of potato three had been tunnelled by larvæ entering through the small, clean areas on the poisoned surfaces. It would seem that a similar happening takes place when cane setts, planted in a wireworm-infested locality, are dusted with Paris Green. As soon as an eye swells and shoots a vulnerable portion of the plant is out of range of the poison protection applied during planting.

Various cyanides have been recommended as controls for wireworms attacking a number of crops including sugar-cane. In many instances, mention is made also of the possible harmful effect of these materials on plant life. Using cyanogas (calcium cyanide) no practical method has been found of successfully applying this material to the control of *L. variabilis* in the Mackay district without seriously injuring the eyes of setts. Even assuming the finding of an efficient attractant it is considered that pre-baiting is economically impossible.

Small doses of cyanogas when placed in the drills with the plants killed all the eyes. If placed at a minimum distance from the plants so as not to damage the eyes, the material was of no use in combating wireworm attack.

Portions of a *L. viriabilis* infested field were drilled out (drills 2 feet apart) and a dose of 200 lb. per acre of cyanogas was buried. Four weeks later, cane planted in these areas was attacked to the same extent as in the untreated parts of the field.

Mechanical Methods.

Hand Collecting of Larvæ.—It has been found that the laborious work of collecting larvæ from furrows behind ploughs is of very little help in decreasing the *L. variabilis* population in any field. Very few larvæ of this species will be seen during ploughing, and on a number of occasions two hours' following of the plough in certain portions of fields has resulted in the collection of not more than fifteen larvæ. When these same portions of fields have been planted, however, as much as 50 per cent. of each of the strikes has been affected by wireworms.

The same point is concerned when it is desirable to know before planting (particularly an early planting) if wireworms are likely to be troublesome. It was found that the apparent absence of larvæ during ploughing operations was not a reliable guide and that the planting and subsequent inspections of trial setts, usually in lots of five in the lowest parts of the fields, was the only satisfactory method of obtaining the desired information.

The Utilisation of Cane Varieties.—A few farmers consider that some varieties of cane are able to "resist" wireworm attacks to a greater extent than others. During the establishment of plots against wireworms many different varieties of cane were used and all were, under similar

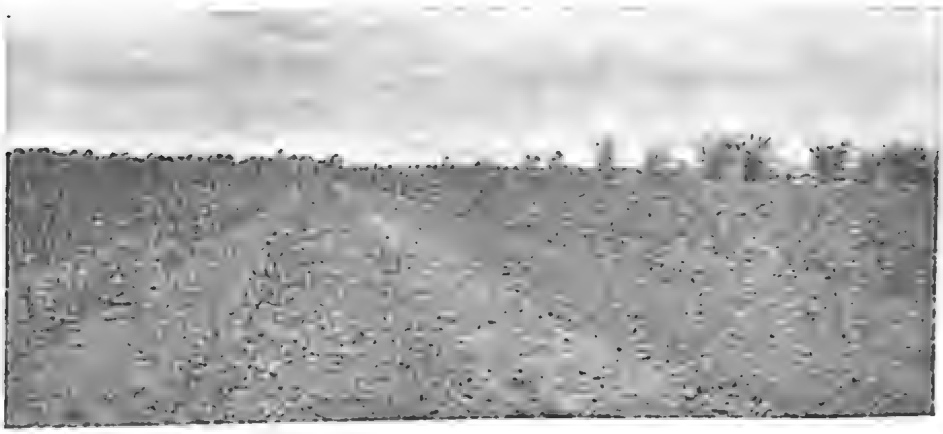


Fig. 1.

Fig. 2.

Fig. 3.

Good strikes obtained in reputedly bad "wireworm" fields after adequate draining at the proper time—i.e., during the summer previous to planting. Fig. 2 shows a "blind end" drain for taking water from an extensive depression in a field. (Photos. by J. Macmillan.)

PLATE 302.

conditions, equally damaged by these pests. When slow-striking varieties were planted out against quick-striking canes in a variety trial, many eyes of the latter class were destroyed before those of the former had been touched. Ultimately, however, the strikes of all the varieties were quite similarly attacked by the wireworms.

In Hawaii cane varieties have been put to good use in helping to solve a wireworm problem. Quoting from a communication (1-2-31) from C. E. Pemberton, Entomologist to the Experiment Station of the Hawaiian Sugar Planters' Association, "At present our wireworm problem has become less important because of the utilisation of cane varieties, such as Uba, which need be planted only once every ten or twelve years. As the plant crop is the only one that suffers, our Elaterid damage to a field is really very slight." Unfortunately, the habitat of the pest, its uneven distribution in many fields, the lack of varieties suitable for the purpose, and climatic and soil conditions make this excellent method of combating wireworms impossible in the case of *Lacon variabilis* in Central Queensland.

Rapid Early Growth and Use of Manures.—The getting away of plants as quickly as possible is often given as a subsidiary recommendation for the reduction of wireworm damage to sugar-cane, it being reasoned that when growth is slow the period of exposure to injury is prolonged. In the Mackay district, farmers point out that in seasons when there is relatively quick striking in "wireworm" country there is very little damage by the pests (*L. variabilis*). Probably, if immediate and apparent planting conditions are similar, the fundamental reason for the quicker striking in some years than in others is that following light or moderate wet seasons the soil has not been waterlogged for as lengthy periods (if at all) as when the wet seasons are heavy. As will be demonstrated later ("Times of Planting and Seasonal Incidence," p. 718) there is a very good correlation between the density of the wireworm population in any year and the intensity of the preceding mid-summer rains. Quick striking of cane and the amount of wireworm damage are both dependent, to some extent, on the wet season, but it has not been found that quick striking is of much help at all in fields where feeding larvæ of *L. variabilis* are actually present in appreciable numbers. It must be remembered that the eyes of setts are not attacked until they are soft and swollen; soaked setts with swollen eyes or small shoots were planted during an early planting in a portion of a field where wireworms were known to be present and the planting moisture was good, but within three days after planting all eyes and shoots had been destroyed.

The use of manures in wireworm control is usually attributed to the stimulating effects on plant growth rather than to any direct contact insecticidal value. In the case of lime it is thought that its real value is due to its effect upon the physical condition of the soil. During 1931 a large lime and fertilizer trial against wireworms was established in the form of a 4 x 4 Latin square. On harvesting it was found that the yields from plots which had received an application of fertilizer in the drills and of lime in the drills were significantly better than the check plots. Results are not significant, however, in so far as the counts of "dead-hearts" and misses caused by wireworms concerned.*

* Yields and percentage shoots and eyes damaged by wireworms:—

C 11·25 46·0%	D 11·79 53·4%	A 9·37 48·6%	B 9·78 42·9%
B 12·56 65·0%	A 11·70 41·6%	D 11·82 70·7%	C 9·95 34·5%
D 12·94 52·4%	C 11·95 53·9%	B 12·79 43·3%	A 11·17 51·2%
A 6·76 59·8%	B 9·40 47·9%	C 8·21 50·0%	D 7·79 42·5%

Variety.—Q. 813.

pH of soil 3·97

Treatments—

A—1½ tons burnt lime per acre, broadcast

B—1½ tons burnt lime per acre, broadcast +(200 lb. super. per ac.), (200 lb. potash per ac.) in drills.

C—No treatment.

D—1 ton burnt lime per acre, broadcast +5 cwt. of lime per acre in drills.

YIELDS.

ANALYSIS OF VARIANCE.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ loge (Mean Square).
Rows	3	30·51	10·17	..
Columns	3	7·19	2·36	..
Treatments	3	2·67	0·89	1·0930
Errors	6	1·28	0·21	0·3709
Total	15	41·65	..	..

Standard Error $=\sqrt{0{\cdot}84}=0{\cdot}92$ or 2·15 per cent.

SUMMARY OF YIELDS.

—	A.	B.	C.	D.
Cane, tons per acre	8·20	8·91	8·27	8·87
Cane, percentage mean yield	95·8	104·0	96·6	103·6

Yields from Treatments B. and D. significantly better than check plots.

PERCENTAGE SHOOTS AND EYES DAMAGED BY WIREWORMS.

ANALYSIS OF VARIANCE.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.
Rows	3	54·83	18·28
Columns	3	384·75	128·25
Treatments	3	150·80	50·27
Errors	6	677·00	112·83
Total	15	1267·38	..

Standard Error. $=\sqrt{451{\cdot}3}=21{\cdot}2$ or 10·5 per cent.

No significant reduction in wireworm infestation resulted from any of the treatments.

Further trials with planting mixtures and complete fertilizers did not indicate that manures would be of any use whatsoever in helping to reduce damage by *Lacon variabilis.*

Some farmers have found by sad experience that it is a waste to place manure in the drills with plants in unimproved wireworm country. Nevertheless, the idea persists in some localities that superphosphates placed in the drills at the time of planting is a control for wireworms, and still other farmers consider that the use of burnt lime alone is helpful in decreasing the damage by this pest. Particular attention has been paid to the use of these materials against *Lacon variabilis.*

Lime (see also Chemical Methods, p. 710).—In addition to several smaller plots, two large plots (4 x 4 Latin squares) were set out incorporating different lime treatments in badly-drained depressions in two fields. The treatments were:—

A.—1 ton of slaked lime per acre, broadcast.

B.—2 tons of slaked lime per acre, broadcast.

C.—No treatment.

D.—1 ton of slaked lime, broadcast, with 3 cwt. of lime per acre in the drills.

Lime was applied broadcast immediately before final ploughing. Neither of the plots could be harvested; in one the strike was a complete failure; while in the second, which had to be very heavily supplied, relevant counts did not give significant results.

A pH survey of wireworm-infested fields showed that *L. variabilis* larvæ inhabited soil ranging in pH (in N/1 KC1) from 3·90 to 5·80, and that parts of any field inhabited by the pests were usually more acid than the remainder of the field. Soil samples for the purpose of this survey were taken from thirty-seven fields in different localities in both the Mackay and Proserpine districts. In the laboratary a series of nine jars containing soils, which at the beginning of the experiment covered a pH (in water suspension) range from 3·5 to 7·0, was adjusted by the addition of calculated amounts of N/5 sulphuric acid and water or burnt lime and water to a soil of pH 5·34. In each of these jars *Lacon variabilis* larvæ not smaller than the fourth instar were placed. It was found that in soil over the pH range under consideration, these larvæ could be quite easily reared to adults. It consequently does not seem that the addition of lime to a wireworm field would affect the wireworms inhabiting it by virtue of changing the pH of their environment. Larvæ have also been kept for considerable periods of time in jars containing half slaked lime and half soil; their behaviour was normal.

Superphosphate.—During the eight to nine months following March, 1932, larvæ were kept in soil and superphosphate; the largest amount of the fertilizer in any of the jars was equivalent to an application at the rate of 150 tons per acre. Ninety-two per cent. of the larvæ, the smallest of which were fourth instars when the experiment was initiated. passed through the larval moults in normal fashion, voraciously attacked

potato tuber when it was supplied to them, and finally emerged as adults. Six out of ten larvæ in the jars containing the very heavy dressing came through to adults. There is no doubt that superphosphate as a direct insecticide, or as a factor in changing environmental conditions, has no deleterious effect on *L. variabilis* larvæ.

In addition to the several trials with fertilizers containing superphosphate, four small plots with superphosphate only were put out. The following is an example of the layout of these small plots and the count (Table V.) as usual, indicates the futility of using this material against *L. variabilis* during a season when the pest is active in any field:—

Check (1)	Super (2)	*Date of planting*: 3–4–32.
Check (3)	Super (4)	*Variety*: Q. 813.
Super (5)	Check (6)	*Treatment*: Superphosphate placed in the drills at the time of planting at the
Check (7)	Super (8)	rate of 882 lb. per acre.

Size of plot: One chain by 4 drills.

Four replications.

TABLE V.

COUNT OF A SUPERPHOSPHATE TRIAL AGAINST *L. variabilis*.

DATE OF INSPECTION—1–5–32.

No. of Small Plot.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Total number of swollen eyes on plants	79	70	70	74	72	76	72	72
No. of apparently good shoots	14	8	5	4	11	6	10	2
No. of shoots damaged by wireworms	17	14	19	30	16	18	14	27
No. of eyes damaged by wireworms	40	44	44	40	38	49	45	38
No. of shoots and eyes damaged by *P. australis*	6	4	2	..	7	3	3	5
*No. of shoots and eyes being attacked by wireworms at the time of inspection	11 (7)	8 (6)	6 (3)	..	2 (2)	1 (1)	1	1 (1)
Percentage of possible shoots and eyes damaged or being damaged by wireworms	90·14	96·96	97·06	94·59	86·15	93·15	85·51	98·51

*This includes apparently good shoots (in brackets) if, at the time of inspection there were no indications above ground level of "dead-hearts."

The Growing of Green Manure Crops and Clean Fallowing.—Many acres of cane land in the Mackay district are planted to green manure crops each year. On well-drained country it is not asserted that these cover crops, which are normally grown between October and March, have anything to do with wireworm infestations, but where the low lands are concerned—i.e., where wireworm damage occurs—many farmers are

of the opinion that the growing of these legumes encourages wireworms. When a green manure crop is successfully grown and ploughed in in a wireworm-infested field, it is thought that the increase in humus may be responsible for the pests attacking the setts. When the green crop is a failure, through water-logging or other reason, it is often considered that this failure may be the partial cause of the wireworms attacking the plants.

As indicated in Table III., wireworm damage occurs in fields covering a range of percentages of organic material in the soil, which is fairly wide for the Mackay district. Again the ploughing-in of an exceptionally heavy bean crop does not to any great extent effect the position of the percentage organic material in the soil in a range of ·9 to 5·4. From field observations, and the results of field surveys and laboratory experiments, there seems to be no relationship between the percentage organic material in the soil and the incidence of wireworm damage.

It might be thought that the growing of cover corps during November-February—i.e., the period of the adult existence of the pest—may provide excellent and attractive cover for the click-beetles. There is no evidence to show that adults of *L. variabilis* have a preference for green manures as cover; in fact, it has been found that they are not selective in this regard. An attempt to keep a portion of a low, badly-drained wireworm field as nearly a clean fallow as practically possible over a November-February period, did not result in the absence of wireworms in the portion of the field during the following twelve months.

Eradication of Couch Grass.—Of all the true grasses in the Mackay and Proserpine canefields, one of the most persistent and one of the most difficult to eradicate is Couch grass (*Cynodon dactylon*), which is very often to be seen in low hollows or depressions, and sometimes elsewhere in otherwise clean fields. It has been suggested that this grass attracts wireworms, and that its removal from fields would be of some use in freeing the soil of the pests. Probably the true explanation of the observations on which this suggestion is based is that Couch grass is quite likely to be present in the habitat desired by *L. variabilis* larvæ, and also that Carab larvæ have been mistaken for wireworms. Considerable numbers of larvæ of *Gnathaphanus pulcher* (see page 699) are to be found amongst the roots of Couch grass. During the past three years over 200 specimens of this larva have been received by us as wireworms found under Couch grass.

Times of Planting and Seasonal Incidence.—It is well known that while early plantings (March-April) may be severely damaged by wireworms, replants in July-August (the time of late planting) in the same fields may sometimes be affected but little if at all. In this connection, the following points in the life history and habits of the pest are of interest:—

1. The adults are present in the fields in greatest numbers during late November and early December; over the period mid-December to February, the adult population decreases very rapidly.

2. Taking early December as the time when the adult emergence is greatest, and adding four weeks for the preoviposition period, two weeks for the oviposition period, eight days for the egg stage, and 163 days for the first seven larval stadia, the time around which very many of the larvæ pass into the eighth larval instar, may be computed to be early July.

3. As, under normal field conditions, the larvæ feed only immediately after moulting, many of those which passed into the eighth instar during late June and early July will have finished feeding by the middle of July.

4. From a consideration of the normal feeding times of a larva, and the fact that the larval stadia progressively increase, it follows that the percentage of smaller to moderate sized instars in the population at any time will bear a direct relationship to the percentage of the larval population feeding at that time.

Briefly summarising these points and their consequences, it is found that during early planting, when many of the larvæ are small or of moderate size, the feeding of the population as a whole is practically continuous. By the middle of July many of the larvæ have finished feeding, while the majority of those present which are still feeding do so individually at less frequent intervals. From the middle of July onwards, the percentage of the larval population which has finished feeding rapidly increases, and chances of obtaining strikes free from wireworm damage improve accordingly.

In July, 1933, many early plantings were affected by wireworms, and if the usual July-August plantings had been possible, there is no doubt that it would have given these pests an opportunity to add to the total of their damage to cane for that year. Winter and spring rains, however, prohibited late planting in wireworm country before September, with the result that strikes free from wireworm attacks were obtained.

Damage to cane by *L. variabilis* is more extensive and more intensive during some years than during others. It is known (McDougall, 1934) that the weakest point (and it is comparatively very weak) in the life cycle of this pest is during the period of the earlier larval instars which must have excessively wet conditions for their survival, especially at Mackay summer temperatures. In Table VI. is set out the rainfall for the past eleven years during the months when the vast majority of the larvæ are present in the fields as earlier instars. When these rainfalls are correlated with the remarks on wireworm damage to strikes during the different years, it will be seen that, as would be expected, the amount of rain during any mid-summer has a very decided bearing on the amount of wireworm damage during the succeeding year. As the rainfall is concerned with wireworm existence inasmuch as it helps, with topographical conditions, to provide suitable environments for the smaller larval instars, its distribution as well as its total amount should be noted. Usually, if the total amount is fairly large, the distribution is such that it helps to keep certain localities excessively wet during a considerable portion of a December-February period. Planting year 1924 (Table VI.) provides a possible exception; here the 14·29 inches in the last part of February would have had more effect on the amount of wireworm damage for that year had it fallen, say, during the middle of January.

TABLE VI.

RAINFALLS IN INCHES, DURING SUMMER MONTHS PRIOR TO PLANTING, AND WIREWORM DAMAGE IN THE MACKAY DISTRICT FOR THE YEARS 1924-34; INFORMATION CONCERNING WIREWORM INCIDENCE IS COMPILED FROM VARIOUS PUBLISHED REPORTS, PERSONAL OBSERVATIONS, AND INFORMATION COLLECTED FROM RELIABLE SOURCES. THE RAINFALL RECORDS ARE THOSE OF THE MACKAY SUGAR EXPERIMENT STATION.

Planting Year.	November.				December.				January.			
	1–7	8–14	15–21	22	1–7	8–14	15–21	22	1–7	8–14	15–21	22
1924 ..	·14	·09	..	..	·15	·76	·07	2·18	·01	..	..	1·81
1925 ..	3·52	·57	1·80	·02	·42	·89	4·59	·27	..	·50	3·78	1·57
1926 ..	..	·31	·17	·05	..	10·90	·03	1·84	1·43	1·32	·87	..
1927 ..	..	..	·44	·69	..	·44	3·96	2·64	·20	1·94	1·63	4·55
1928 ..	·25	1·17	..	1·73	..	13·29	9·72	13·60	..	·24	1·68	1·56
1929 ..	1·47	·27	·05	5·10	·29	5·89	1·91	·56	2·35	7·74	1·73	4·51
1930 ..	..	..	..	·90	·36	..	..	2·37	3·79	·78	5·33	19·04
1931 ..	·01	..	..	1·21	·83	·10	1·68	·10	..	·23	·56	3·33
1932 ..	·61	..	1·14	3·92	5·08	·16	..	·93	·45	..	23·70	1·36
1933 ..	·18	..	·02	1·82	·09	1·83	·74	5·37	..	..	·02	7·25
1934 ..	·42	9·46	1·93	·01	·16	4·91	·39	·26	·66	·40	·78	3·17

Planting Year.	February.				March.				Rainfall for period Dec.-Feb.	Wireworm Damage.
	1–7	8–14	15–21	22	1–7	8–14	15–21	22		
1924 ..	3·33	2·09	1·47	14·29	2·10	1·70	·09	..	26·16	A few strikes damaged
1925 ..	4·13	·23	..	2·83	1·99	1·71	9·71	1·27	19·21	Strikes damaged by wireworms scarce
1926 ..	·01	3·78	·04	·06	·46	3·70	·68	4·52	20·28	A few strikes only damaged by wireworms
1927 ..	1·69	4·38	·07	1·54	3·48	5·87	·95	·42	23·04	A few strike only damaged by wireworms
1928 ..	3·43	6·02	9·60	9·44	8·97	·09	·15	13·31	68·56	The worst "wireworm" year on record. Damage both intensive and extensive
1929 ..	1·47	·44	·41	10·45	·03	7·48	1·58	3·08	37·75	Damage plentiful
1930 ..	2·10	·36	..	1·92	2·56	·03	·43	1·37	36·05	Damage plentiful
1931 ..	5·13	·01	·01	·17	·04	·13	2·03	3·11	12·05	Very little damage
1932 ..	..	·24	·74	1·02	·36	·15	·05	·20	33·68	A fairly bad "wireworm" year
1933 ..	5·30	9·23	4·97	1·42	·65	..	..	·31	36·22	Many strikes damaged during early plantings (*see* also p. 719)
1934 ..	2·72	·03	3·62	2·91	2·59	·81	·75	1·15	20·01	A few strikes only damaged by wireworms

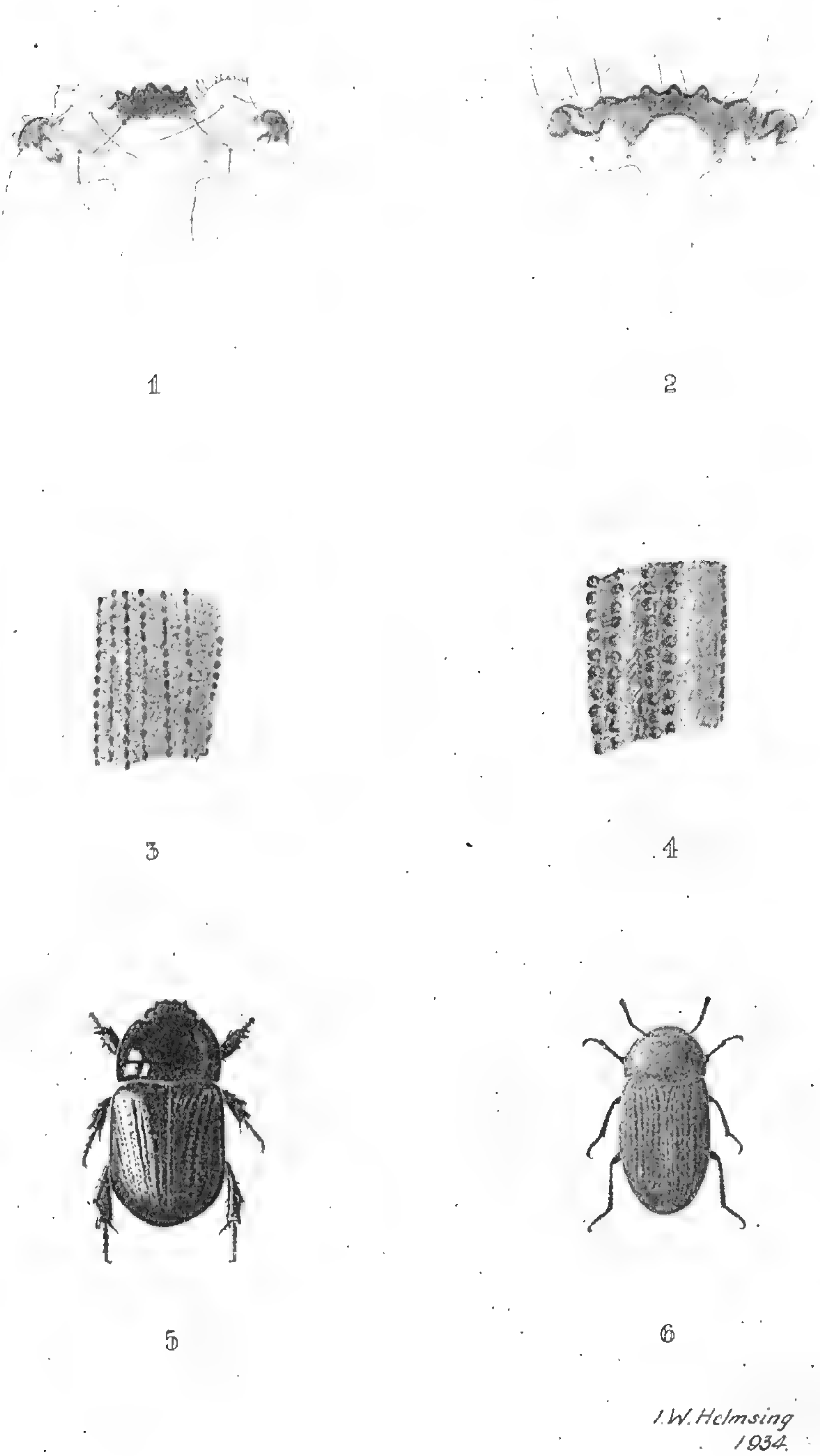


PLATE 303.

Fig. 1. Epistome and nasale of *H. carinatus* Blbn. x 24.
Fig. 2. Epistome and nasale of *L. variabilis* Cand. x 24.
Fig. 3. Portion of left elytron of *L. humilis* Er. x 15.
Fig. 4. Portion of left elytron of *L. variabilis* Cand. x 15.
Fig. 5. Adult of *Metanastes vulgivagus* Olliff x 2.
Fig. 6. Adult of *Dystalica mackayensis* Carter x 3.

Supplying and the Uses of some Cultural Practices performed immediately before or after planting.—As would be expected from a consideration of the preceding section dealing with times of planting, the supplying of wireworm misses with setts is very unsatisfactory. Such supplying to a damaged early planting usually means a more or less continuous performance if a full stand of cane is to be obtained. Supplying to a late planting may not be a distinct success unless the operation is deferred until as late as September or October.

In Fiji and Hawaii (Williams, 1931) a rather effective measure used against wireworms there "is to plant sufficient setts, over and above the regular amount, so that later on, if need be, the surplus can be used to fill in any gaps in the rows caused by the pests." The cost of labour, extent of damage in a large proportion of wireworm-affected fields, and weather conditions militate against the economic possibility and success of this transplanting in Central Queensland.

More as a matter of interest than as an experiment from which practical results could be expected, a trial was set out in which three-eye setts were planted vertically. One eye was just above ground-level. Certainly, the two lower root-bands of each sett provided roots, and the top eye, in many instances, a shoot, but the resultant stand of cane was very unsatisfactory.

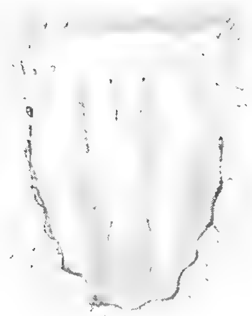
It has been found that the thorough preparation of the land by ploughing operations or the rolling of the land and/or drills after planting has no effect whatsoever in preventing damage by *L. variabilis.* If these pests have become established in a field in sufficient numbers to cause appreciable damage, it can be safely stated that their presence will be felt, irrespective of any economic cultural practices which are likely to be undertaken around normal planting times.

Drainage.—The important finding of several workers on the control of "low land" species of wireworms is briefly stated by Metcalfe and Flint (1928):—"Certain species of wireworms are abundant only in poorly-drained soils The proper draining of such soils will entirely prevent damage by these species."

Naturally, as on many occasions, wireworm damage in Central Queensland mill areas had been noticed in low, badly-drained country, drainage had been recommended as a control of the pests, but drainage as practised by most of the local farmers did not seem to reduce wireworm damage. Nevertheless, as this investigation proceeded, it became more and more apparent that there must be some fundamental connection between bad drainage and the incidence of wireworm damage.

In a consideration of drainage as a control of *L. variabilis* there are several points from field observations concerning this pest and *Heteroderes carinatus,* from the studies of the life histories and habits of these two Elaterids, and from local drainage practice, which stand out as being very significant. These are—

1. The adults of both species will oviposit in soil under similar conditions. *Lacon variabilis* adults are usually found in very damp situations, but it is considered that the only reasons for this are—(*a*) the disinclination of the species to migrate; and (*b*) the secluded habits of the beetles making the finding of them in the fields, if they are not present in numbers, rather difficult.



1

2

3

4

I.W.Helmsing.
1934.

Plate 304.

Fig. 1. Dorsal view of 9th abdominal segment *H. carinatus* Blbn. x 15.
Fig. 2. Lateral view of 9th abdominal segment *H. carinatus* Blbn. x 15.
Fig. 3. Dorsal view of 9th abdominal segment *L. variabilis* Cand. x 15.
Fig. 4. Lateral view of 9th abdominal segment *L. variabilis* Cand. x 15.

2. The smaller larval instars of *Lacon variabilis* must have excessively wet soil environments for their survival, whilst under similar conditions at the same room temperature those of *H. carinatus* cannot exist; in this latter instance a moderately moist soil environment is needed.

3. The older larval instars of both species can withstand varying environmental soil conditions. They flourish under similar conditions in the laboratory, but in the fields the larvæ of *L. variabilis* are almost exclusively confined to low, badly-drained country, and those of *H. carinatus* to the well-drained lands.

4. In fields or portions of fields where damage by *L. variabilis* occurs there are no natural or other permanent drainage systems. Drainage, if any, generally consists of the bedding-up of the fields during the ploughing operations immediately prior to planting.

If it is feasible to assume, as indicated above, that the distribution in the fields of *L. variabilis* and *H. carinatus* (the two species of Elaterid larvæ most commonly found in cultivated canefields in Central Queensland) is, to a large extent, dependent upon the soil moisture conditions encountered by their smaller instars, the drainage of *L. variabilis* infested country during the time when the larval instars are very small should control the pest. Similarly, it would follow that the bedding-up of wireworm fields immediately prior to planting—i.e., when the majority of the larvæ are over their early stages, would have no controlling effect on the pest. Local drainage methods as carried out in No. 4 above have time and again proved the latter portion of this conclusion to be correct.

From October, 1932, to June, 1933, weekly soil moisture samples were taken from both wireworm-infested and wireworm-free parts of fields on four farms in widely-separated localities. The different soil types encountered and the lack of an entirely suitable "single value" soil constant do not tend to make the interpretation of the results of this sampling either easy or accurate. However, for most field purposes, it can be said that on *L. variabilis* infested parts of fields, surface water will be present during considerable portions of the December-February period prior to the planting year (*see* Plate 301). The most heavily wireworm-infested portion of any of the fields concerned in the soil moisture sampling was under water for six weeks (periods of one and a-half weeks and four and a-half weeks) during December-February.

For the purpose of correlating laboratory and field work on the relationship of wireworm existence and soil moisture of environment, the results of the soil moisture sampling were taken as indicating that when the soil moisture of a part of a field is very close to or above its sticky point for considerable periods over December-February it is a suitable habitat for *Lacon variabilis*.

During the years 1932 and 1933 several farmers found that their strikes in erstwhile wireworm fields were quite free from damage after they had scooped headlands, filled in or drained depressions, bedded up the fields, and provided efficient outlet channels for the surface water during the mid-summer rains prior to plantings (Plate 302, figs. 1, 2, and 3).

RECOMMENDATIONS.

The following methods, given in order of preference, for combating the wireworm *Lacon variabilis* as a pest of sugar-cane in the Mackay and Proserpine mill areas, are recommended as worthy of being put into general farm practice. Several progressive farmers have used these methods and, up to the present, have found them to be quite satisfactory:—

1. Permanent drainage of low-lying fields.

2. If, for economic or other reasons, permanent drainage is not practicable, the fields should be thoroughly drained as early as the mid-summer rains or wet season immediately prior to planting, and *not* left on the flat until ploughing operations during the month before planting.

3. If proper drainage is not carried out, planting should be left until as late as possible. Perhaps two reasons why fields may not be adequately drained could be mentioned:—(*a*) It is well known that the incidence of wireworm infestations in many fields is seasonal, and it is considered by some to be worth while trusting to luck for good strikes on these low fields or parts of fields at normal planting times. Often the initial expense of improving say, a depression of 1 acre in a field of 5 acres is not considered to be worth the immediate benefits obtained from such work. The fact that such an improvement is nearly always a permanent improvement and asset to the farm is overlooked; (*b*) some fields are so low that during most wet seasons it is not possible to drain them efficiently other than by a community drainage scheme, or at a very high cost. Many of these very low fields consist of a rather sandy soil above impervious clay. The low sticky point of the soil adds to the difficulties of draining these fields to a degree of efficiency sufficient to prevent wireworm habitation. The few damaged strikes found during a poor "wireworm" year are on this type of country.

Those who entertain reason (*a*) should be prepared, if their normal plantings are failures, to replant in September-October, and hope that the following early and mid-summer rains are such as to allow of reasonable working of the young cane.

ACKNOWLEDGMENTS.

It is desired to acknowledge the courtesy of Mr. R. Veitch, Chief Entomologist, Department of Agriculture and Stock, in making available the services of Mr. T. W. Helmsing, to whom thanks are due for the plates which have been prepared in such an excellent manner.

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The Toxicity of Yellow-wood.

(Terminalia Bursarina).

By K. S. McINTOSH, B.V.Sc., Animal Health Station.

ON the 1st October, 1931, a report was received from the District Inspector of Stock, Emerald, stating that losses among sheep were occurring in the district. Yellow-wood came under suspicion.

Later in 1931, a specimen of Yellow-wood was forwarded to the Botanist, who identified it, and stated that he did not know of any feeding tests or chemical analyses conducted with it.

The Chemist reported that the presence of saponins, alkaloids, hydrocyanic acid, was not detected on chemical analysis of the plant.

In March, 1933, the Senior Instructor in Sheep and Wool reported "Rickets" or "Staggers" in sheep and suspected Yellow-wood as the cause.

On 28th May, 1933, Mr. D. F. Stewart, B.V.Sc., visited Codenwarra and planned an experiment to test the toxicity of Yellow-wood, Mr. McCosker, owner of the property, having generously offered the Department sheep, pens, and all facilities for conducting the test.

On 18th August the sheep were penned, twelve test sheep numbered 1 to 12 and eight controls numbered 1*a* to 8*a*. The sheep were Merino wethers, 4 years old, and brought to Codenwarra from Barcaldine. There is no Yellow-wood at the latter place. The sheep were in fair store condition when the experiment started. The yards used are concrete draining pens. They are well fenced and shade is provided by means of a piece of hessian.

Although this experiment is not yet complete, the following progress report is submitted as it is felt that the results so far are typical of natural grazing on Yellow-wood leaves.

The Experiment.

The test sheep are given just as much Yellow-wood as they would clean up, night and morning, commencing on 18th August, 1934. The amount given was not weighed as the leaves are not removed from the branches.

The Yellow-wood was collected on the property from trees carrying most abundant foliage. Leaves were fully matured old leaves, no young leaves were fed. Trees were not in flower.

The control sheep were first given 1 lb. of lucerne chaff each per day. Later this was increased to 1½ lb. and later still 2 lb. The chaff is of good quality and free from molds and foreign plants.

At first water was supplied in kerosene tins, but later the sheep were allowed to water at a creek near by.

On 5th September, 1934, No. 1 sheep was off feed, dopey, and sick. Conjunctiva was yellow and icteritic; this sheep died on 11th September, 1934. Post mortem revealed enteritis and impaction. Solid lumps of plant fibre were found in the intestines. Liver and kidney appeared smaller in size than normal.

Following this, half an ounce of Epsom salts was given to test sheep as they were slightly constipated, but not to controls as these were normal.

On 24th September, 1934, test sheep were given ½ lb. lucerne chaff per day each, which was later increased to 1 lb. As the sheep put on condition the amount of lucerne chaff was decreased.

On 25th September, 1934, No. 2 had first "fit." Two more followed in yard whilst sheep were being weighed. On 28th September, No. 4 sheep showed symptoms of dopiness, loss of appetite.

October 3rd, No. 2 still taking "fits."

October 3rd, No. 4 still "sick" and "dopey."

October 6th, No. 8 appeared sick.

October 8th, No. 4 sheep appeared to be dying. It was killed and a most-mortem examination was held. All organs appeared normal. A nasal bot (*Oestrus ovis*) was found in the upper part of the nasal cavity.

October 13th, No. 8 began to take "fits."

October 18th, No. 11 sick.

October 22nd, No. 11 began to take "fits."

Since 25th September, 13th October, and 22nd October, Nos. 2, 8, and 11 respectively have been taking "fits."

On 25th October I visited the holding to make observations.

When pen was approached No. 11 immediately took a "fit," which lasted about ten seconds, then took another about five minutes later. When milled about in the yard Nos. 2, 8, and 11 all took several "fits" within half an hour. The sheep were raced up and down about 100 yards lane when the three affected ones took several "fits."

All three sheep were poor in condition, being much thinner than control and non-affected test sheep. On examination there were no demonstrable lesions except abrasions which were sustained during the "fits."

Nature of "Fits."

The sheep drops in its tracks as though stunned and lies trembling and rigid with extensor muscles of the neck and limbs strongly contracted. The sheep sometimes lies quite prone and sometimes props itself up and sways its head from side to side. The attack lasts from ten to forty seconds and recovery is quick. The sheep struggles to its feet and stands for a few seconds swaying unsteadily, then runs away to join the mob.

The presence of strangers, loud noises, and driving all seem to induce the attacks. Whilst sitting on the fence of the pen, No. 11, which appeared to be the worst affected, took "fits" about every five to ten minutes for about forty minutes. If sheep are driven continuously after "fits" no harm seems to result.

General Remarks.

Mr. McCosker informed me that the Yellow-wood tree sheds its leaves from autumn to late spring, depending on the season. In a cold dry season, practically all leaves fall in cold weather. Sheep eat leaves when they fall particularly when grass and herbage are scarce.

There is a clump of Yellow-wood trees just inside the gate of one of the paddocks, and when sheep are put in here they immediately feed on the Yellow-wood trees.

There does not appear to be any mineral deficiency on this property. In 1931 the owner supplied lick for sheep, but hardly any was taken.

Season.

No rain from the time sheep were penned till 12th October when 66 points fell. There have been a few showers since.

Since this report was submitted Mr. Hardy, District Inspector of Stock, Emerald, has reported that Nos. 11 and 2, which were placed in the control pen, have gradually improved, and Nos. 5, 10, and 12 have begun to take fits.

Summary.

1. Yellow-wood causes a peculiar type of nervous disorder, or fits in sheep fed on it.
2. The leaves are not unpalatable to sheep.
3. Losses of weight in experiment were probably due largely to the unnutritious nature of the leaves as compared with lucerne chaff (fed to controls) except in the case of affected sheep, which showed marked emaciation.
4. No actual deaths following nervous symptoms have yet occurred. The two deaths recorded seem to have been caused by the indigestible nature of the plant.
5. From information supplied by the owner losses by death appear to be almost, if not solely, due to sheep collapsing among branches and stones or falling into waterholes, &c., when seized with a fit.
6. According to Mr. McCosker's experience and my own observations considerable loss in wool production and condition results from the ingestion of Yellow-wood.
7. Unlike the nervous symptoms caused by Stachys arvensis, no harm seems to result if affected sheep are driven continuously.

Acknowledgments.

This experiment was planned by Mr. D. F. Stewart, B.V.Sc., and is being supervised in the field by Mr. Hardy, District Inspector of Stock, Emerald.

The Department is very grateful to Mr. McCosker, of "Codenwarra," who supplied sheep, pens, and other facilities for carrying out the test.

TO SUBSCRIBERS—IMPORTANT.

Several subscriptions have been received recently under cover of unsigned letters. Obviously, in the circumstances, it is impossible to send the Journal to the subscribers concerned.

It is most important that every subscriber's name and address should be written plainly, preferably in block letters, in order to avoid mistakes in addresses and delay in despatch.

The Story of Butter and Cheese throughout the Ages.

By O. ST. J. KENT, B.Sc.*

THE story of butter and cheese takes us back to the early history of mankind, when dairying was in a very primitive state, and when dairy herds consisted of goats, cows, camels, mares, and sheep, owned by wandering tribes.

The milk from these animals was used as food, and entered largely into the diet of these early people. But milk, under ordinary conditions, does not keep very long, and it would have gone badly with these people, in times of scarcity, if they had not discovered some means of preserving the valuable nutritive constituents of milk. This they did by converting milk into butter and cheese. Just how long ago the first butter and cheese were made cannot be definitely stated, but the early writings give us some conception of the age of these two important articles. In the Scriptures, butter and cheese are mentioned on many occasions, and as far back as the Book of Genesis (18:8), we read that "Abraham took butter and milk and the calf which he had dressed, and set it before them." Other very early references appear in the writings of the Hindoos about 2000 B.C. The remarkable feature about all such early references is that the mention of milk, butter, and cheese is, in every case, incidental, and implies their previous use for an extended time.

Herd-testing an Ancient Custom.

While these two products were primarily made for food, they were utilised by different races for different purposes, and some of the uses to which they were put are very interesting, indeed.

In India, about 4,000 years ago, butter was well known, and besides being used as a food, it was also used for sacrificial purposes. In passing, it should be mentioned to the credit of the Hindoos of that period (i.e., about the year 2000 B.C.) that they valued their cows according to their yield of butter. Herd testing is therefore a very old custom.

A Highly Developed Art.

The Greeks and Romans ate plenty of cheese, but they did not use butter very much for food. This was probably due to the fact that cheesemaking was a highly-developed art with the Greeks and Romans, whilst the making of butter was confined to Germany and other northern European countries. It was quite possible that, by the time the butter reached Rome and Athens, its flavour was anything but pleasing, a factor that evidently influenced its consumption by those Mediterranean people. The Greeks and Romans used butter more as an ointment to enrich the skin and as a dressing for the hair. They also used it for skin injuries, and considered that soot from burnt butter was good for sore eyes. In Tartary, a piece of butter dropped into a cup of tea was considered very delicious by these people.

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* In a broadcast address from Radio Station 4QG.

Butter as a "Cure-all."

In Spain, as late of the seventeenth century, butter was on sale in chemists' shops as a cure-all, to be used, as was specifically stated on the label, "for external use only." Its use as a dressing or cooling salve for burns and bruises has been practised all through the ages, and even to-day we find butter recommended for this purpose. Less than 100 years ago, large quantities of butter were burnt as oil in lamps, in no less a country than Scotland. Times must have been hard for the dairymen in those "good old days," for Scotch folk certainly have the reputation of being thrifty.

To-day, butter is almost exclusively used as a food, and few of us would consider purchasing it for any other purpose. In its early history, butter was enjoyed as a food by comparatively few people. Those who did use it, seldom ate it fresh. The practice was to melt the butter before storing it, and it was usually employed in cooking, rather than as a spread. In India to-day a substance known as Ghee is essentially melted butter fat, and its preparation undoubtedly follows a method that has been handed down through many generations.

Butter and Class Distinction.

Apart from the uses already mentioned, the possession of butter and cheese by these ancient people was long regarded as indicating wealth, and served as a means of distinguishing the rich from the common people. Butter was often stored by burying it in the ground, allowing it to remain there for years, and very often a tree was planted over it so that it would not be disturbed. Under these conditions it turned deep red and was highly prized. The owner's wealth was determined by the quantity that he had stored up in this manner. Even at the present time, evidences of this old custom are to be found in certain towns of northern India.

In years gone by, the Irish people used to bury their butter in bogs, either for the purpose of storing it against a time of need, or to hide it from invaders, or for the purpose of developing a flavour. It has been said that the Irish, and other peoples of early times, acquired a taste for rancid and high-flavoured butter; and this is supported to some extent by a quotation from Butler's Hudibras, which runs—

"Butter to eat with their hog
Was seven years buried in a bog."

Samples of this Irish Bog butter are dug up from time to time even to-day, although the practice of burying butter ceased in Ireland about the end of the eighteenth century. Quite recently two lots of butter were found buried in a peat bog, one in County Leitrim, wrapped in a skin, and the other in County Tyrone, contained in a tub with perforated wooden handles. The colour of these butters was greyish white, but they showed a few small specks of the original butter yellow in the interior. They were brittle and waxy and smelt like rancid tallow, and did not contain salt. Many such samples have been claimed from the bogs of Ireland, and archæologists have been able to show, from the nature of the decorations on their containing vessels, that these butters were buried, in some instances, as far back as the eleventh century.

In modern times we reckon the wealth of nations in terms of butter and cheese, and we also bury these products, but instead of putting them

under the ground, we bury them in cold stores under conditions that are well regulated and hygienic.

Ancient Methods of Manufacture.

Butter and cheese in olden times were evidently not the choice flavoured, attractive foods which we know to-day. It should be interesting, therefore, to see what methods were adopted in ancient times for the manufacture of butter and cheese, and to compare them with modern methods. Let us consider the methods of making butter first of all. The principle underlying butter-making is a simple one. Milk or cream is simply agitated until the small fat particles unite to form butter granules. The process of agitation or concussion necessary to make butter is called churning, and the churning may be accomplished in two ways. In the first method the milk or cream is churned by rocking or swinging the churn. In the second method, the churn does not move, but the cream inside the churn is agitated by means of a revolving paddle, or some similar contrivance inserted into the cream.

Both of these methods were adopted by the early primitive people, and they have been used in butter-making right down through the ages, even to the present day. The only difference is in the design of the apparatus employed, and the conditions under which the manufacture is carried out.

The earliest references to butter-making comes from India, and these were recorded in the sacred songs of the Hindoos about 2000 B.C. According to the historian Martiny, these ancient people made butter in a stationary type of churn. The milk was placed in earthern vessels and given a querling motion, either by beating it with the hands or by stirring it with a stick, flattened at one end. These were the forerunners of the modern dash-churns, which are used on many farms and in many households to-day. In a modern dash-churn, the dasher or agitator is either a piece of perforated wood or metal, which fits closely into a vertical churn.

The ancient Arabs and Hebrews used churns, of a rolling, swinging, or revolving type. Animal pelts were sewn up to hold milk, and thus constituted the churns. These crude churns were fitted to the bough of a tree, or in some other manner, and swung to and fro, after the fashion of a child's swing, until butter was formed. Sometimes a portion of the trunk of a tree would be hollowed out to form a churn and swung in a similar manner.

As civilisation progressed, churns of a better type were constructed, and to-day in our up-to-date factories we have huge barrel-shaped churns, driven by machinery, which are capable of turning out a ton of butter in one batch. There is a vast difference in the size, design, and mechanical perfection of the modern churn, when compared with the crude ancient churns, but the principles involved are the same to-day as they were 4,000 years ago. The modern churn has simply developed as a result of the gradual improvement of primitive equipment. It is easy to realise now, that butter obtained from churns made of animal skins could not have the same appeal to the consumer as does our modern butter, which is manufactured from pasteurised cream, and churned under excellent conditions.

The principles underlying cheesemaking to-day are also the same as they were thousands of years ago, but in modern times the methods employed are much improved, and are more scientific. Cheesemaking

is a simple process to describe. Milk is made into a junket as a result of the addition of rennet. The junket is cut up into small pieces, which are warmed to enable the curds to separate from the whey. The whey is drained from the curds, which are then salted and pressed into the shapes which are so well known as cheese. When the first cheese was made, we do not know; but it must have followed closely on the use of milk of animals as food. The processes adopted in different countries differed slightly, with the result that cheese of many different names were soon known. To-day there are more than 500 different varieties of cheese listed. The commonest and the best-known cheeses have taken their names from the country in which they were first made. Thus we have Stilton and Cheddar from England, Camembert and Roquefort from France; Gruyère from Switzerland, Limburger from Germany, Edam and Gouda from Holland, and Parmesan from Italy. As people from these countries migrated to other countries, they naturally carried with them the knowledge of cheesemaking peculiar to their native land, and established their methods in their new homes.

Cheddar Cheese.

The cheese which is made almost universally in Australia is called Cheddar cheese, introduced in the early days by settlers from England. Something of the history of Cheddar cheese may therefore be of interest. The first written record concerning this class of cheese is given for the year 1635, although it was evidently made for many years before that date. It receives its name from a little village in Somerset, where it was first made. At that time, almost 300 years ago, Cheddar cheese was in great demand, particularly when well ripened, and the cheesemakers found it difficult to supply that demand. In 1742 the price of Cheddar cheese was stated to be 6d. per lb. in England, a price which is rather interesting, in view of the fact that present prices are not so very different.

Progress in Manufacture.

In Australia some other types of cheese are being manufactured on a small scale. Swiss cheese or Gruyère cheese is made here now, and contrary to a somewhat common belief, it is made from cows' milk and not from goats' milk.

The most recent advance in the cheese industry is the preparation of a rindless cheese which is usually wrapped in tin-foil and attractively packed. This type of cheese is called "processed cheese," and is manufactured from Cheddar cheese by heating it in a special apparatus.

The great progress which the butter and cheese industries have made in the last thirty years or so has been due to many influences. The application of the Babcock test, which has enabled the farmer to be paid according to the butter fat which he sends to the factory, is amongst the most important. Another factor which had a tremendous influence on the dairying industry was the introduction of the farm separator. This machine changed the system of selling dairy produce entirely. Instead of the farmer conducting a milk business, it enabled him to conduct a business in cream, with its many obvious advantages.

The application of pasteurisation to butter and cheese has also had a profound influence on the development of this great industry, and last but not least, the application of scientific principles in regard to all phases of manufacture, has been instrumental in bringing butter and cheese to the standard of quality attained to-day.

H. W. BALL, Assistant Experimentalist.

EXCELLENT rains were experienced throughout the farming areas during November, so that the main summer crops should now be well established. November and early December is generally regarded as the most favourable sowing period for maize in this State, so that the tasseling stage will coincide with the late summer rains. Maize is Queensland's chief grain crop, large areas of fertile coastal and downs land being suitable for its production. The favourable seasonal conditions have also given a great fillup to the dairying and grazing industries.

WHEAT.

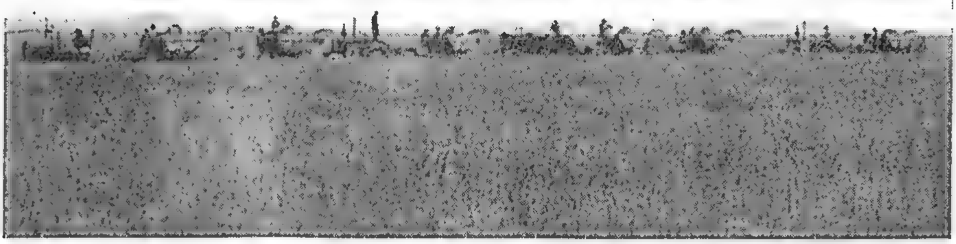
Reports of early harvesting operations indicate good average yields throughout the Downs area, many crops going over ten bags per acre. Unfortunately, the rains experienced have caused delay in harvesting the later crops, which, if prolonged, will affect the quality of the grain. The modern header harvester will gather all but the worst storm-lain crops, but some bleaching and shelling out of varieties such as Florence is naturally expected. However, harvesting prospects at the time of writing are much better than in 1933.

SUGAR.

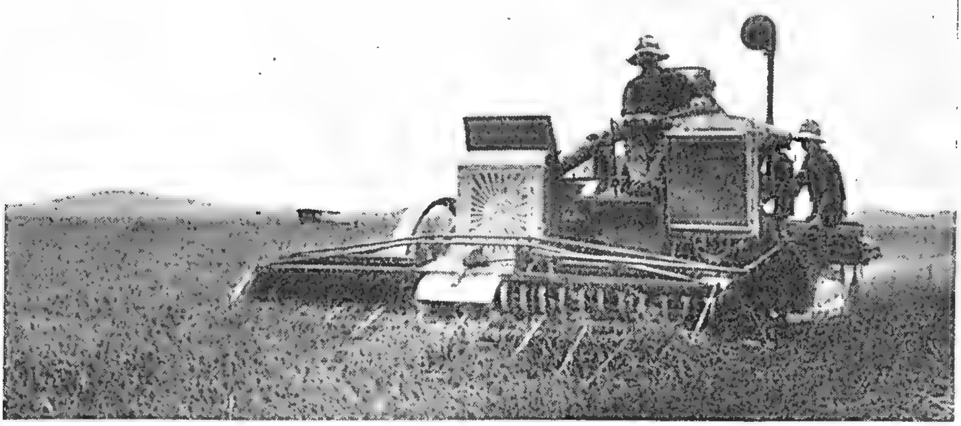
The month of November has been characterised by higher temperatures and beneficial thunderstorms in all cane areas. The crop is, therefore, making rapid growth, and prospects are bright for the 1935 crop.

The majority of the mills have completed crushing. Though the crops in the far North have been light, those of the Central and Southern areas approximate to record tonnages. The Burdekin mills have a large proportion of the crop still to harvest, while several of the Southern mills ceased crushing when an appreciable proportion of the crop was left as standover cane for 1935.

ON QUEENSLAND'S WIDE WHEAT LANDS.



Tractor-drawn Auto-headers at Work on Zeisemer Bros.' Crop, Bongeen, Darling Downs.



Auto-header Working on a Lodged Crop on Mr. J. Flegler's Farm, Evanslea, Darling Downs.

Grist for the Mill.—After the Auto-header has passed through Mr. J. Flegler's Farm, Evanslea, Darling Downs.

Plate 305.

RECLAMATION OF PRICKLY-PEAR LANDS.

The prickly-pear has been routed on all fronts, and the menace of further encroachment overcome. Although regrowth and seedling pear

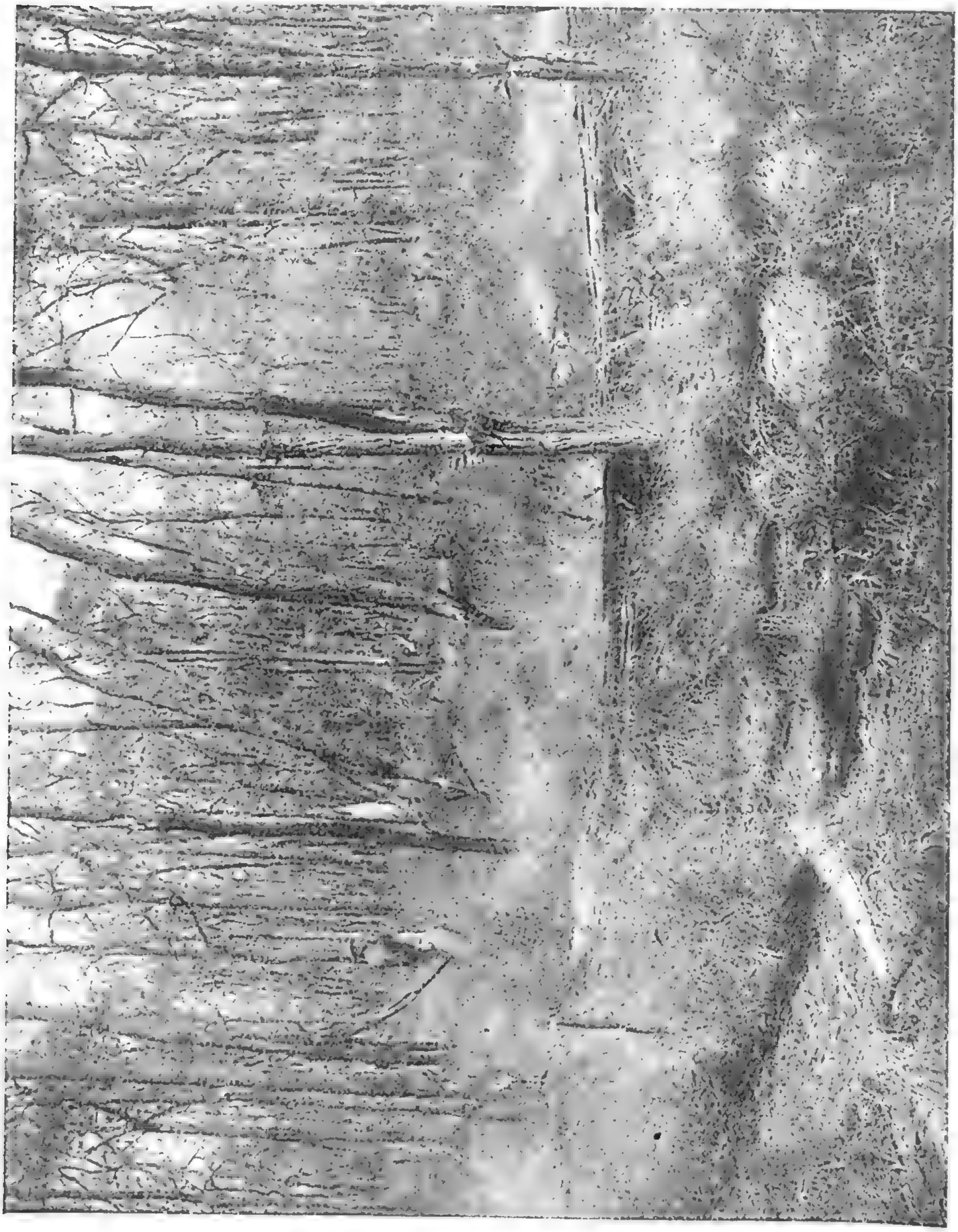


PLATE 306.—BRIGALOW AND BELAH SCRUB RINGBARKED EIGHTEEN MONTHS AGO NOW CARRYING A HEAVY COATING OF NATURAL AND NUTRITIOUS GRASSES. [*Photo., J. A. Lunn.*

will be in evidence for many years, it is safe to say that the cactoblastis will attack it with equal success. When the biological campaign was begun, about 60,000,000 acres in Queensland and New South Wales were either infested or subject to infestation, much of it so dense as to be regarded as lost territory. These lands have now been recovered, and ringbarking and other development works are proceeding. As much

of the land will carry a sheep per acre when improved, the reclaimed lands will be supporting many millions more sheep within ten years.

Plate 307.—Light Belah Scrub just Ringbarked.—Reclaimed Prickly-pear Land, Western Queensland.

Many selections are now changing over from cattle to sheep, and considerable demand exists for any resumed lands as they become available. For instance, 286 applications were received for one block of land recently balloted for at Chinchilla.

COTTON.

The cotton areas, with the exception of a few favoured sections, may be described as about a fortnight late in obtaining general planting rains. Generally speaking, most of the crop was planted in the latter

half of October, following light storms which occurred frequently enough to ensure good strikes being obtained where well-prepared seed beds had been established early. A considerable acreage was ploughed following the first of the October rains, and fortunately ample soaking rains have occurred in the first half of November to allow these areas to be planted in good shape. Altogether, it is anticipated that fully 60,000 acres are under cotton this season.

The value of thorough early cultivation of the young cotton crop was well demonstrated during the past excessively wet season, and growers are making determined efforts to keep ahead of weed growth this year. The rains during the latter part of November have thoroughly soaked the soils to sufficient depths in practically all districts to ensure ample supplies of soil moisture, and clear warm weather is now required to enable the thinning and cultivating of the crops to be carried out properly.

TOBACCO.

Early sowing is favoured in the Texas and Yelarbon districts, the plants being now well established in the field, and the first gathering of leaf is expected in January. Seed beds are still being prepared in the Northern areas, where growers favour periodical sowings until assured of adequate supplies. Planting-out is mainly accomplished during December. Control methods adopted for preventing disease are proving effective, although prolonged wet conditions will necessitate increased vigilance. Some damping-off is reported, owing to keeping the seed beds closely covered up after watering. This can be prevented by adequate ventilation. The excellent tobacco lands in the Bowen district are attracting attention, two growers having averaged 33d. and 36d. respectively for their entire 1934 crop. In this district good results have followed planting-out as late as February and early March.

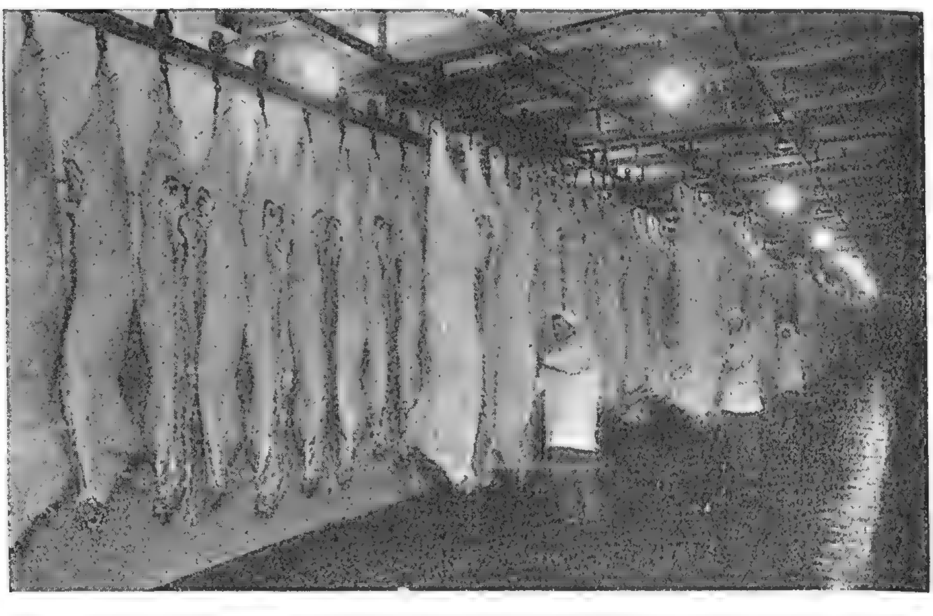


PLATE 308.—CHILLING FOR EXPORT OVERSEAS.

[*Photo. by courtesy of Queensland Meat Industry Board.*

E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

PART V.

THE WESSEX SADDLEBACK.

THE most recent introduction to Australia of the lesser-known British breeds, the Wessex Saddleback, has an historical record full of interest to the student of live stock husbandry.

History of the Breed.

The breed originated, like several other breeds in that part of the world, from the mating of two of the original types indigenous to England, a black-coloured breed originating in the New Forest—from whence sprang the Tamworth—and the old English Sheeted breed, so called because of its peculiar colour markings. It is on record that this new Wessex breed was not influenced in any way by the types which made the Yorkshire and Berkshire pigs famous—the Chinese and possibly the Neapolitan breeds. Perhaps this isolation was due to the locality in which the Wessex originated—the Isle of Purbeck, in the early days a part of the New Forest country. Later, a similar type was bred in Hampshire, an offshoot of which in these days has gained fame in America, where it is still referred to as the Hampshire, in colour and type not unlike the Wessex Saddleback as we know that breed to be.

Among other names that have characterised this breed in England is the Sheeted Hampshire, the type reputed to be the originator of the American breed of similar name. W. J. Malden informs us in his review of this breed in the Jubilee Issue of the "Pig Breeders' Annual," that the maintenance of the Wessex pig in pure-bred form was due largely to two families, one at Plaitford and the other at Langford, where they had been maintained pure for over ninety years. These and their descendants in the neighbourhood formed the main basis of the pure Wessex as we know the breed to-day.

A Wessex society was formed in 1918; it issued herd books regularly, and amalgamated with the National Pig Breeders' Association of England quite recently.

The Wessex breed was originally developed for, and all along has been maintained, as a bacon pig, no attempt having been made to cross it with any other type for purposes of breed improvement. Such a breed must of necessity build for itself a reputation, for breeds are not established in a day, considerable effort and patient work being necessary to gradually mould a type into a recognised breed. It is unnecessary in this short review to discuss the early breeders of this type; sufficient to say they were and are well known to British stud masters, and the fact that the National Pig Breeders' Association thought so much of the breed as to be prepared to sponsor its interests speaks for itself.

PLATE 309.

Lined up at the feeding trough.—A scene on Mr. R. Turpin's farm at Lowood, in the Brisbane Valley district.

Characteristics of the Breed.

In his review, Mr. Malden offers the advice worth consideration here that it is unwise in a breed of this description to strain too much after length to the detriment of other qualities. It is claimed that the Wessex breed is a meaty and not a fatty breed, hence a medium length, thick, meaty carcass will be preferred to one with more length but less meat. As a breed, the Wessex is included in the list of medium-framed breeds, not as large as the Large White and not as compact as the Berkshire.

As regards their suitability for Queensland and Australian conditions it is early yet to commend strongly or condemn a breed of which we have had but very limited experience. I would say that, from my experience, I consider the Wessex distinctly a bacon pig in its purebred form. As a purebred pig, and judging from the standpoint of the stud pig breeder, it would be fair to say this breed is disappointing, in that the number of well-marked pigs suitable for sale as show animals is very small, too limited in fact to make the breeding of Wessex pigs as purebreds a payable proposition. If colour is to be a secondary consideration, a very doubtful and risky procedure, the breed would

figure to more advantage; but as they have to compete with whole-coloured breeds like the Large and Middle White and the Tamworth, and with a breed like the Berkshire, which produces a higher percentage of well-marked pigs, progress in the breeding of Wessex Saddlebacks will be slow and difficult.

Insufficient purebred animals of this breed have been available for slaughter in Queensland to be able to make a fair comparison, and with such a limited number of purebred animals available the future of the breed is certainly still in the balance—in fact until more data favourable to the breed is available locally one could not honestly recommend them except for experiment purposes. Their colour, and the fact that for choicest grade porkers they do not dress out to the same advantage as pure white pigs, present a slight hindrance not so noticeable in bacon pig production. It is possible, too, that where breeding is neglected or carried out on rough and ready lines, the Wessex would not show up to advantage in competition with, say, the Berkshire-Tamworth cross.

PLATE 310.

Championship winners at the Gympie District Show—the property of Mrs. A. Alford, of Traveston. These Wessex pigs are thoroughly typical of the best in this breed in Queensland.

OTHER BRITISH AND AMERICAN BREEDS.

This review of breeds of pigs would not be complete without passing reference to other British and American breeds that have been tested out and used in Australia, and in Queensland in particular.

The Large Black Breed.

This breed, formerly known as the British Large Black and the Devon breed, originated in Devonshire and has had a fairly wide distribution throughout the world. This breed has been bred and distributed widely in Australia.

Large Blacks were bred at the Hawkesbury Agricultural College, New South Wales, and at many other farms in that State, and Victoria; also to some extent in Queensland. Unfortunately, although this breed has points in its favour and could be used to advantage, there are so few really good Large Blacks in the Commonwealth that one is compelled to issue a warning against the use of this, one of the oldest of British breeds. They have, however, a long and honourable record

in the land of their origin, and, perhaps, may some day regain some of their former popularity in Australia.

The Gloucester Old Spot.

This breed is another having its birth in the environs of Gloucestershire, in the British Isles.

Somewhat large and loose in frame, having long-lopped ears and generally regarded as a very growthy breed, these Old Spotted pigs appealed to many breeders, especially as the sows, like the Large Blacks, are prolific and heavy milkers. Unfortunately, there is a coarseness about the G.O.S. which makes it unpopular, and unless breeding is very carefully controlled—which, unfortunately, is not the case on many farms—best results are not obtained.

It is quite unlikely that the G.O.S. will regain its former but temporary popularity, especially as even in Great Britain they are giving place to more popular types like the Large and Middle White.

PLATE 311.

Born and bred in Queensland from imported parents, this young Wessex sow is the property of Mr. R. Turpin, of Lowood.

Other British Breeds.

Other British breeds that have not been introduced into Australia, but have their share of popular favour in the United Kingdom, are:—The Cumberland, the Essex, Large White Ulster, Lincolnshire Curly Coated, National Lop Eared, and the Welsh National Pig (sometimes referred to as the British Landrace pig).

American Breeds.

Of a number of breeds of pigs originating in the United States of America, three only have been introduced into Australia. Named in order of merit as judged by length of time bred here, they are:—The Poland-China, the Duroc-Jersey, the Chester White.

The first two mentioned only will be referred to herein, as the Chester White, apart from being introduced and tried out, has not proved suitable, and has been deleted from our list of breeds. In fact, American breeds generally are not favoured in Australia, and are gradually being eliminated in favour of the more popular and suitable British breeds.

In America the hog is considered as the principal medium for converting corn into coin, and as the American people are great believers in both corn and coin, they have specialised in the production of animals that will most efficiently "walk their crops to market," and convert their corn crops into dollar bills with the least waste, in the quickest time, and with the expenditure of as little labour as possible.

Plate 312.

A comparison of type between the Wessex and the Tamworth, this prize-winning Tamworth sow, "Traveston Alice," bred by Mrs. A. Alford, won several championships for Mr. Mat. Drummond, of the Wide Bay Stud Piggery, Gympie, Queensland.

In pursuance of this policy of developing live stock specially suited to the purpose, several breeds have been evolved that have earned for themselves an enviable reputation, particularly in the United States, the world's greatest hog-producing country.

Of these, the first two referred to have had the widest distribution, the Poland-China having been bred in Australia for fifty years or more, although the modern type, of which there are still a few representatives available here, is comparatively a recent introduction.

In actual cross-breeding tests carried out in Queensland over a series of years, the Poland-China, in its association with breeds like the Large White and Tamworth in particular, gave very satisfactory results; even although the type of Poland-China available was not considered the most suitable.

Market requirements have changed so much in recent years, and the demand for more flesh and less fat has become so pronounced, that any breed with a tendency to produce an excess of fat must be discounted. For this reason, both the Poland-China and the Duroc-Jersey must be looked upon as undesirable breeds. They are not recommended by Queensland bacon-curers, although lengthy lean types of similar conformation are not actually objected to.

PLATE 313.
A foundation sow in the herd of Mr. C. G. Dale, of Lagoon Pocket, Queensland, this prize-winning Tamworth sow was bred by Mr. J. Barkle, of Kingaroy.

Our recommendation is to concentrate on the four breeds specially commended by the bacon-curers—the Large and Middle Whites, the Berkshire and the Tamworth—for in these breeds there is a sufficient range of types to enable selection to be made to suit varying needs. Besides, any advantage possessed by American breeds can be developed in British types by careful breeding, feeding, and management.

As we have it, the Poland-China is marked much the same as the Berkshire, although more white marking is permissible. In America there is another type—the Spotted Poland-China—very similar to the type that existed here thirty years ago.

The Duroc-Jersey is the red hog of America, developed like the Poland-China for purposes of utilising maize as the principal food.

The Chester White is a more lengthy, upstanding type fashioned along bacon lines.

All the American breeds we have possess small drooping ears; they are more cylindrical in frame than the Berkshire, which is squarely set; and they have an aptitude for fattening very readily on a minimum of food. There are several other American types that have not been introduced, two already referred to being the Hampshire and the Spotted Poland-China. The Mule Foot is one of the lesser-known American breeds reported to be immune to the more serious diseases like swine fever, in America known as hog cholera.

Plate 314.—Good-quality Export Porkers.

[Photo. by courtesy of Queensland Meat Industry Board.

The Queensland Pig Industry Act.

PROVISIONS EXPLAINED.

DESIGNED entirely in the interests of Queensland farmers who are producing pigs as a profitable branch of live-stock husbandry, "*The Pig Industry Act of* 1933" was assented to on 11th October, 1933, in the Queensland Legislature, having received Royal Assent in accordance with State law. The Act actually came into operation on 23rd August, 1934, which date is referred to as "the commencement of this Act." The Act is divided into twenty-five sections, while there are twenty-three additional provisions in the Schedule to the Act, which latter are largely covered by the Regulations. Sections 1 to 4 of the Act may be referred to as the administrative portion, covering, among other things, interpretation of various terms used in the text—thus, the word "dealer" is interpreted as meaning "any person who engages in the buying and selling of pigs or pig carcasses"; "piggery" means and includes any land, buildings, or place where pigs are depastured or kept; and similarly with other terms.

Inspectors under this Act have, for the purposes of the Act, all the powers and functions of an inspector under "*The Dairy Produce Acts,* 1920 *to* 1932," "*The Diseases in Stock Acts,* 1915 *to* 1931," "*The Slaughtering Act of* 1898," or any Act or Acts amending the same or in substitution therefor respectively.

Section 5 gives the inspector power of entry and inspection, and in his official capacity he may enter and inspect any premises or place where pigs are depastured or kept, and any factory. He is empowered to deal with any position arising as a result of unclean piggeries, disease in pigs, impure or unwholesome water or food, &c.; and he may forthwith order the necessary steps to be taken to remedy the defect.

Section 7 sets out the duty of the owner in notifying disease; isolating diseased pigs; disposing of diseased carcasses.

Section 8 prohibits the feeding of meat, offal, or blood unless such foodstuffs are thoroughly cooked.

Section 9 requires the owner to render any assistance required by the inspector in the carrying out of his duties, and in searching for and discovering the cause of disease or any source of contamination or infection to which pigs may be exposed.

Section 10 deals with the marking of pigs by a representative of a factory—i.e., a sufficient mark to ensure identification of the vendor or consignor if pigs are forwarded direct to a factory. Such identification marks are, of course, necessary in the ordinary course of marketing; otherwise there would be endless confusion.

Section 11 requires every auctioneer, agent, dealer, factory, or butcher to keep a record in respect to every transaction in pigs with which he is concerned—that is, the date, number, description, distinguishing marks, name and address of vendor and of purchaser, and such other particulars as may be prescribed.

Section 12 prohibits payment for the whole or any part of a carcass which has been condemned by an inspector as unfit for food of man; this is an important section, as payment for diseased carcasses has proved to be a most unsatisfactory way of eliminating disease.

Section 13 deals with grading of carcasses, and is more fully described in dealing with the Regulations.

Section 14 provides the inspector with power in marking of quality of carcass pork and bacon sides.

Sections 15 to 25 give powers of administration under this Act and provide for penalties in case of offence, &c.

The Schedule to this Act covers a fairly wide range of provisions and deals with subject-matter covered by regulation.

THE REGULATIONS.

In the Regulations additional terms are interpreted—thus, the grader is the person duly appointed as such under the Act and/or his assistants duly appointed under the Act.

A saleyard is a live-stock market operating as a saleyard, a receiving and/or trucking yard, or place where pigs are sold, bartered or exchanged, or otherwise disposed of, &c.

Regulations 1 and 2 are purely administrative.

Regulation 3 sets out requirements in conduct of examination of graders and/or inspectors under this Act, and is largely an administrative clause.

Regulation 4 provides that no person shall be employed in the grading of pork or bacon pig carcasses unless he holds the necessary certificate of competency under this Act.

Regulation 5 deals with management of piggeries which are not specifically provided for in any of the other Acts under which inspectors work in administering this Act.

Provision is also made that pigs shall not be allowed to trespass or to pollute running water. This Regulation also provides the inspector with powers to prevent introduction and spread of disease among pigs, &c.

Regulation 6 deals with identification of pigs, and requires that every pig offered for sale, barter, or exchange be identified in accordance with this Act and its Regulations, the object being to facilitate tracing of disease to source of origin. This Regulation is a particularly important one that will require the hearty co-operation of everybody interested in the progress of the pig industry.

Regulation 7 deals with grade definitions and defines the various grades into which carcasses will be graded by the grader at the factory.

Provision is made for two particular grades in each group—thus, there will be in baconers for the Australian trade a grade defined as choicest, and another first grade; carcasses not coming within these grades will be second grade or smallgoods grade, as the case may be.

In export baconers and in export porkers the grades are those required by the *Commerce (Trade Descriptions) Acts,* 1905 *to* 1930, and are the grades in operation at present under Commonwealth veterinary inspection.

In porkers for the Australian trade, in addition to the two grades referred to as "G.A.Q." (good average quality) and "F.A.Q." (fair average quality), there is a second grade and a reject porker grade. Boars and stags shall be accepted, graded, and paid for only when of suitable quality and age for manufacturing into edible products.

Regulation 8 deals with payment for pigs sold for slaughter, and requires that in the case of choicest or highest grade carcasses there shall be paid a premium of one halfpenny per pound above the rate paid for next grade. It is felt that the introduction of this system of payment will be entirely satisfactory, and will do much to encourage the breeding and marketing of better quality and properly finished pigs. This Regulation provides that when live pigs are sold at public auction and where carcass pork graded as provided is sold at public auction and/or by private contract, the clause requiring payment of premium shall not apply, for the reason that purchase of pigs at public auction and carcass pork ditto or by private contract requires the buyer to pay maximum value to secure the best quality offering, and, therefore, payment of an additional premium would not be workable.

Regulations 9 and 10 deal with the sale of live pigs by public auction and sale of carcass pork respectively.

Regulation 11 provides for the issue with account sales of grade certificates—i.e., where pig carcasses are paid for on a basis of grading. It is desirable the farmer be informed as to the reason why carcasses are paid for at below choicest or highest-paid grade, if they are so graded and paid for; and this Regulation paves the way for this information to be supplied.

Regulation 12 provides for check grading and for vendor to be supplied with a certificate of grade of all carcasses other than those of highest-paid grade.

The check grader shall also determine the grade of any carcass reduced in value by causes obviously occurring after purchaser has taken delivery from vendor. This clause provides for losses due to injuries in transit, &c., not actually covered by any preceding or following clause.

Check grading protects interests of the farmer and should be the means of providing him with necessary information, for, as stated, the farmer is to be informed in all cases where his pigs are not of choicest grade. It is hoped to be able to follow up grade certificates and indicate to the farmer how to overcome faults in type and condition, and how to produce and market the most desirable class of animal.

Regulation 13 deals with grade marks, and paves the way for identification by indelible grade marks of graded carcasses, thus preventing errors and enabling a more accurate check to be kept of the different grades. Where grading is carried out by Commonwealth officers (as in the case of pork for the export trade), only such grade marks as are required under the *Commerce (Trade Descriptions) Acts*, 1905 *to* 1930, will be applied.

Regulation 14 provides for compulsory refund of price paid for any pig whose carcass is subsequently slaughtered and condemned within thirty days of sale by Government inspectors as unfit for the food of man. Many pigs are purchased in Queensland and are paid for prior to slaughter. All such pigs come within the ambit of this Regulation and thus are brought into line with those consigned direct to factories and not paid for until slaughter and inspection is complete. The Regulation makes it compulsory for the purchaser to demand the refund, and for the vendor to pay within a stated period. This clause will, it is believed, be of inestimable benefit to the industry in this State.

Regulation 15 has reference to a similar subject, but deals with the purchase of live pigs by dealers who thereafter consign to factories for slaughter within thirty days. In this case the dealer is placed on the same footing as the farmer, and will be compelled to refund in case of condemnation. This clause will apply to every such transaction between a dealer and an owner of a factory.

Regulation 16 requires the owner of a factory to supply to the Minister a list of trade marks used, &c.

Regulation 17 requires the owner of a factory to supply to the Minister a list of all products manufactured or sold by such factory.

Regulation 18 provides for the use of more than one trade mark where so desired by the owner of a factory.

Edible products shall be identified with a different trade mark from inedible products such as fertilizer.

Regulation 19 makes it an offence to beat a pig with a whip, stick, or other weapon capable of bruising or damaging the carcass of such pig. Similarly, it will be an offence to ill-treat a pig in any way, penalty being such as is provided for in the Act.

Regulation 20 indicates the scope of the Regulations and is largely administrative.

PLATE 315.—CHAMPION POLLED SHORTHORN BULL—A RECENT IMPORTATION.

[*Photo. by courtesy of Queensland Meat Industry Board.*

Fruit Market Notes.

By JAS. H. GREGORY, Instructor in Fruit Packing.

Apples.

IT is at this period of the year we often find consignments of so-called cookers which, as a rule, consist of small, immature, green fruit. Fruit of this description always has a detrimental effect of a lingering nature on market values from which it takes a long period for prices to recover. If sending early apples to market as cookers, growers should take care to see that the size of the fruit is not less than $2\frac{5}{8}$ in. in diameter. Fruit of this size and larger will sell as cookers where smaller fruit is unsaleable. At the present time—late November—some splendidly-packed lines of Yates and Sturmers of good quality from Victoria and Tasmania are arriving and realising up to 12s. per case. Green fruit could not compete successfully with this fruit.

Stone Fruits.

Plums, apricots, and cherries, with lines of local peaches, are now arriving in quantities. Good, well-packed lines are meeting with a ready sale. Some consignments of Stanthorpe fruit have shown traces of fruit fly. This should serve all growers as a warning to take all precautions possible to prevent a spread of the pest. The rainy weather towards the end of November did not assist in helping to make a good early-season beginning. The humid conditions hastened considerably the breakdown of some of the riper lines. Care must be taken by growers to ensure that no wet or damp fruit is packed for market. Only dry and well-cooled-before-packing stone fruits will carry and open up to perfection. Again a warning is given to pay strict attention to packing-shed cleanliness if brown rot is to be kept in check.

Citrus.

The Queensland citrus season is now drawing to a close. It has not been a successful season. Small-sized fruit has been the cause of low prices during the greater part of the year. Serious attention will have to be given in the future to the elimination of fruit of this description, which has all along helped to create glut conditions. Two-inch mandarins and $2\frac{1}{4}$-inch oranges have proved particularly unsaleable throughout the season, and if the percentage of this quality had been eliminated an almost normally-supplied market would have resulted.

Tomatoes.

The quality of tomatoes during November has been one of the best ever produced in the State. Some splendid consignments have gone to Southern markets. The standard of maturity of the fruit this season has been raised far ahead of previous years. It would appear that this has had a stabilising effect on the markets, preventing speculators from buying at green prices and holding for a rise. As the warmer weather is with us, care must be shown in not sending fruit too far advanced in colour to distant markets. Packing has also shown improvement; the benefit of the school packing classes of previous seasons is now being felt.

Papaws.

Prices for papaws have increased considerably on the local market. Quality should still be the keynote of papaw marketing, all spotted or fungus affected fruit being carefully rejected. Although Melbourne weather has remained cool through November, warmer conditions can soon be expected, when papaws will need to be carefully selected to avoid the risk of their arriving over-ripe on the Southern market.

Pineapples.

With the winter crop over, pines generally are scarcer on the market. The shortage of pines and citrus on the markets is offset by the increased supplies of stone fruits arriving on the market. Medium-sized pines are selling readily at fair prices, but buyers are not keen to operate on small fruit. Growers sending South are gradually changing over to woodwool packing, which opens up in a much sweeter and less musty smelling condition than blady grass.

Miscellaneous.

Attention is drawn to the publication of a packing chart for apples in the standard export case. A packing chart for the Australian dump case is in course of preparation, and advice will be given in these notes when it is completed. Packing charts may be obtained free on application to the Under Secretary, Department of Agriculture and Stock, William street, Brisbane.

Charts for both the dump and standard cases are now available for oranges. A lemon-packing chart is in course of preparation.

Intending apple exporters should watch for the appearance of the new grade standards for the exporting of apples, which will be published as soon as they come to hand.

The attention of growers marketing locally and using second-hand cases for packing is drawn to the fact that in many cases old brands are not removed from cases and replaced with the grower's name, address, variety of fruit, and grade. Growers have had to be dealt with for infringements of this kind which, it is hoped, will soon cease.

DEHORNING DAIRY CATTLE.

The dehorning operation should be performed while the animals are young. The dehorning of calves is best accomplished by the application of caustic to the horn "buttons"—the two small protuberances which can be felt when the animal is a few days old on either side of the poll where the horns emerge. The skin immediately surrounding each button should first be protected by smearing it with vaseline, and the button itself then carefully rubbed with the caustic pencil. Should the caustic touch the skin severe burning will occur, and areas of skin will slough off. For the same reason the caustic must not be handled with the fingers, but slipped for use into some metal holder, such as an ordinary pencil-holder. Four applications are usually sufficient, when the buttons will peel off, this marking the completion of the treatment.

The operation is thus performed without any pain to the animal, and the method is quite the most effective and humane. Adult cattle are sometimes dehorned by use of a special instrument, several kinds of which are upon the market, but it is a painful operation and is not recommended.

If cattle prove troublesome in the yard by horning others, much damage can be prevented by sawing off the ends of their horns, leaving them quite blunt. Care should be taken not to remove too much of the horn, and the sawn ends should not be filed round.

Crown Land for Selection.

TOCAL SHEEP COUNTRY.

Approval has been given for the opening for Grazing Homestead Selection of a subdivision of Tocal Resumption at the Land Office, Longreach, on Thursday, 17th January.

The block contains an area of about 30,000 acres, and is situated on the south side of the Thomson River, about 55 miles south-west from Longreach. The term of lease will be twenty-eight years, and the annual rental 2½d. per acre for the first seven years of the term.

The block embraces an area of very open downs, with a small area of fairly well-shaded gidyea and boree country. The remainder is open boree downs country, pebbly in places, and well shaded in patches.

Grasses consist of Mitchell, blue, water couch, &c., and the country is fattening. Fair woolgrowing and suitable for breeding.

Improvements consist of tanks, sheep yards, boundary and intersecting fencing. The present water supplies are sufficient.

The valuation of the improvements is £1,821.

The selection must be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years, and proof must be furnished of the financial standing and pastoral or land experience of the applicants.

Free lithographs and full particulars are obtainable from the Land Agent, Longreach, the Land Settlement Inquiry Office, Brisbane, and the Government Intelligence Bureaux, Sydney and Melbourne.

PLATE 316.—M.V. "IDOMENEUS" LOADING FIRST EXPERIMENTAL SHIPMENT OF CHILLED BEEF AT THE BRISBANE ABATTOIR.

[*Photo. by courtesy of Queensland Meat Industry Board.*

The White Man in the Tropics.

The following addresses by Professor A. GRENFELL PRICE, C.M.G., D.Litt., F.R.G.S., of the University of Adelaide, were broadcast over the National Network from Stations 5CL and 5CK on the 11th and 18th July, 1934.

I HAVE been asked to speak to you on the very important and unsolved problem of whether the white man, and particularly the Nordic white man, can settle permanently as a worker in the tropics. So this evening I will tell you about the question in general and what has happened in other lands, and next Wednesday I will deal with an aspect that is so vital to Australians—the problem of whether we, as a white people, can hope to live in and develop the vast, but almost empty, areas of tropical Australia—a region of nearly 1,150,000 square miles. I need hardly emphasise how vital is this question to the Commonwealth. Again and again other nations have called us "dogs in the manger," because of our "White Australia" policy as regards these empty tropics, and only recently the Dean of Canterbury voiced a very usual opinion that we should give North Australia to the Japanese.

But we are not the only white people who are involved in the tropics. Britain, France, and the United States have great tropical possessions, and I found American scientists intensely interested in their own tropical problems in Florida, Panama, and Puerto Rico, and most anxious to hear Australian views.

The truth is that throughout the world leading scientists are disputing over this question of the ability of white people to settle the tropics. Some Americans, such as the well-known Professor Ellsworth Huntington, believe that whites cannot live there permanently, because they are destroyed by the climate. Other scientists, like General Gorgas, of Panama fame, and the Australian Dr. Ray Cilento, consider from the records of Panama and Queensland that the whites can colonise the tropics if they overcome disease. A very great authority, the late Sir Andrew Balfour, took a mid-way position, but at his death he seemed to be swinging towards Cilento's views.

Definitions.

Let us begin by defining White, Settlement, and Tropics. By White we mean people who are white, or nearly white, such as the Europeans, the people of Canada, the United States, and Australia, and the near white peoples of Costa Rica or Cuba. By Settlers we mean people who live, work, and have families for generations in the tropics, and we exclude officials, missionaries, soldiers, and traders who go to the tropics only for a time. By Tropics we mean the earth's surface roughly between 23½ Lat. N. and S., but this covers regions of very varied heat, rainfall, and humidity, and some areas will be far more suitable than others for the whites. We can exclude from our study many regions such as the African or Australian deserts, where no one can live, and many countries such as India or Java, where the whites will never form a working population as the coloured people and their cheap labour are overwhelmingly competitive. Thus we can narrow our inquiry to a few possible areas. The most important of these are North Australia, parts of North, Central, and South America, and the West Indies.

There are three ways in which scientists are attempting to examine the question —the methods of history, of statistics, and of the laboratory. Unfortunately, history is not a very accurate guide, as the progress of medical science has completely changed white prospects in the last few years. The statistical method is not wholly reliable.

It is difficult to secure absolutely satisfactory figures of climate, heredity, &c., even in civilised countries. The laboratory method is also uncertain, for when you test people under artificial conditions of heat or moisture in a laboratory you cannot reproduce the exact conditions which face them when they have to undergo acclimatisation in a tropical zone. By combining the three methods, however, one can find out a great deal about whether the whites are really making progress.

The White Man's Conquest.

The history of the white man in the tropics is very fascinating. From 1500 onwards European nations carried out a great pre-scientific conquest of the tropics. The Portuguese, Spaniards, English, Dutch, French, and other nations poured into tropical Asia, Africa, America, and Australia, and either conquered or destroyed the native coloured peoples. Before very long, however, the tropical diseases and the tropical peoples began to regain their own. In India, Java, Africa, or Mexico the whites continued to hold sway as governors or traders, but each generation returned home, for if they remained they were absorbed like a river flowing into an ocean. In sparsely-inhabited countries, such as the West Indies, the whites destroyed the natives, but, instead of working themselves, the whites brought in negro slaves, and these negroes increased so rapidly that the white masters were soon absorbed. In India, the Portuguese tried the interesting experiment of deliberately breeding a half-caste people, but even this proved impossible, and ultimately the half-castes will be absorbed. Nevertheless, this white pre-scientific wave left some interesting flotsam and jetsam, and many fascinating books have been written on the little communities which have survived. Central America and the West Indies are full of such groups of white people, and, perhaps, we might even call the settlement at Darwin one. In 1932 and 1933 I was lucky enough to examine a number of such communities—Costa Rica in the Central American highlands, where an almost pure Spanish community has survived for 400 years; Jamaica, where a German community came about the same time as the German pioneers of South Australia; and the little and almost unknown island of Saba, where an English-Dutch community has kept almost pure white since the days of the English buccaneers and first Dutch planters—a period of 250 years.

Without going into scientific details, I will simply say that the evidence shows that white men can live and work for generations in the more favourable tropics, provided that they are protected both from disease and from the presence of coloured races, who are usually unhealthy, and are far more dangerous to the white man than any tropical climate. In Costa Rica one found a white Spanish community—artistic and educated—which had kept pure white because the people had been isolated on the plateaux, and because the negro had been excluded until comparatively recent days. This exclusion of the negro is of the utmost importance. Only this week a letter came from an American scientist in Costa Rica to say that the Government so fears the rapid increase of the negro population that it is completely prohibiting negro immigration. It is the same in Saba. There one found a very fair type of pure white English-speaking people who had always done a great deal of their own hard work, but are now in danger, like the Costa Ricans, of being absorbed by negroes.

Control of Tropical Diseases.

After the old pre-scientific invasion of the tropics by the whites had failed, a new and far more promising invasion occurred. From 1890 onwards the British and American scientists learned the control of hookworm, yellow fever, malaria, and many other tropical diseases, and the worst enemies of the whites were partly subdued. On the Panama Canal, for example, "the pest hole of the world," the Americans showed that it was possible to secure a lower death rate than in the most healthy cool temperate countries, and the white death rate to-day is lower than even that of Australia or New Zealand. I spent some three weeks with American scientists in Panama, and saw white Americans who, with very few

vacations in the United States, had carried out the hardest physical labour in the workshops for nearly thirty years. One also saw whites of the second generation who were doing the hard work perfectly well. As for the tropics injuring children, an exhaustive examination in 1930 showed that white children in Panama were, on the average and right up to the end of their high school days, of higher standard than similar white children in the United States. The same thing is going on in Southern Florida, where white fruitgrowers are working in a climate that is truly tropical—and the same type of evidence is now coming from the white sugar growers on the Queensland coast, who are actually doing work that the Americans think no white man can possibly perform. We could, however, copy much from the Americans at Panama, for their control of disease, hygiene, and sanitation, and their methods of housing, clothing, and diet are unequalled anywhere in the tropical world. Our figures in Queensland would be even better if we would follow some of their ideas.

We must not, however, be too optimistic because of these successes. What is really happening in Florida and Queensland is that the white man, in particularly favourable regions where economic factors are particularly suitable, is beginning to penetrate the margins of the tropical zone. The great American doctor, General Gorgas—who conquered yellow fever in Cuba and Panama—made the mistake of being over-optimistic because of his successes, and thought quite wrongly that the whites would be able to colonise any part of the tropics. In reality, we are just beginning to understand that we are facing a huge and complex scientific problem, and that the future progress of white people in the tropics depends on a large number of geographic and economic controls. To take only one example, even a small region like Panama has great local varieties of climate, and there are probably in the climate, as affecting white people, a number of factors that are as yet unknown. Similarly, one race is more suited to the tropics than another, and even in a single race there are some individuals who are suited to the tropics, and others who can never acclimatise. This point was strongly emphasised by Dr. Sunstroem, when working in tropical Australia. The Americans are now talking about establishing in Panama a Research Institute to study the process of acclimatisation in various individuals, and a branch of such an institute would be of extraordinary value if founded to study thoroughly the effect of climate on white workers on the Queensland coast.

Soil.

Another vital control is soil. The world is gradually abandoning the old fallacy that almost all tropical soils are fertile. Australia, for example, would have saved a vast wastage in lives and expense had she realised that her Northern Territory soils are some of the poorest anywhere.

Housing.

Isolation is also important. We are beginning to realise that loneliness and inter-breeding have harmed many white communities more than tropical climates, and that small scattered settlements, such as some of those in North Australia, have little chance of meeting with success. Comfort is also of vital importance, particularly for women. One of the greatest hopes for white settlement in the tropics lies in air conditioning the houses. Very soon the white man in the tropics may be able to control the temperature of his dwelling as easily and effectively as the American controls the winter temperature by central heating. Then again, there is the importance of social habits and of food and drink. Many failures in the tropics, particularly British failures, have been partly due to ridiculous clothing, heavy unsuitable diets, and alcoholic excess. Again and again when a young man died of drink in the West Indies, his parents were charitably informed that he had died of fever, and that good old whipping post—the tropical climate—took the blame. Again, we are beginning to realise how dependent the white peoples of the tropics are on temperate policies and markets. The Americans turned

Puerto Rico and Cuba into lands of one crop industry—dependent on the cool temperate sugar markets. Now the United States is refusing to pay a profitable price for sugar, and when the unhappy, starving Cubans explode in riot and revolution, the supposed instability of a tropical people is blamed.

The Colour Barrier.

Most important of all we are beginning to realise that the greatest barrier to white settlement in the tropics is neither climate nor sickness, but the presence of vast masses of coloured peoples, who, as we know from the history of the Kanakas in Queensland, lower the standard of living, create reservoirs of disease, and form the means by which the whites can shirk doing the essential physical work.

From Washington to the Equator, every American scientist I encountered said ''You Australians are the wisest people on earth with your 'White Australia Policy',''' and this dictum rests on indisputable facts. The health of white people in the Southern United States suffers appallingly from the presence of millions of negroes, while the West Indies and Central America are steadily going black. Jamaica, for instance, which once had thousands of white settlers, is now coloured to 96 per cent.

In this address I have tried to explain the general controls which govern white settlement in the tropics, and I have attempted to give you some idea of the great question in other parts of the globe. Next Wednesday, I will apply some of these principles to our own great problem, and will deal with our strange record of success and failure in the northern tropics, and the difficulties that confront Australians—or any other people—white or coloured—who attempt to settle the North of this great continent.

THE PROBLEM OF NORTH AUSTRALIA.

In my address last week I told you about the general question of white settlement in the tropics. I explained why the white invasion of the tropics failed in the days before modern science, and why the new and scientific invasion of the marginal tropics was meeting with some success. Finally, I tried to show that the future progress of white settlement would depend not merely on the successful combating of tropical climate and disease, but upon many other factors, such as soils, communications, housing, food, and drink, the exclusion of coloured peoples, and economics. To-night, I will apply these general principles to the history and prospects of white settlement in tropical Australia, and will deal with the pre-scientific invasion which failed, the new scientific invasion which appears to be making some headway in Queensland, and the factors which will determine whether any nation, white or coloured, can settle the North of this great continent.

As the Spanish say, ''There are tropics and tropics,'' and we cannot begin to understand the problem of our North unless we realise that we keep a variety of tropics in North Australia. While we possess no equatorial lowlands, like the Congo or Amazon Basins, we have four other kinds of tropics: the tropical trade wind coast of Queensland; the tropical plateaux; the interior deserts of Western Australia, Queensland, and the Northern Territory; and the wet-dry region, that great belt of country, with a monsoonal rainfall in summer and a drought in winter, which runs right around the Australian North and North-West coast. Throughout the world the high plateaux with their cooler climates are the most suitable parts of the tropics for white settlement, but in Australia, out of 46,000 square miles of tropical plateaux over 2,000 feet in elevation, only 14,000 square miles of Queensland plateaux have rainfall and soils sufficiently good to support many whites. Also, we can eliminate completely from the viewpoint of any close white settlement (except, perhaps, for a few temporary mining camps) the whole of the desert or arid regions which have less than 15 inches of rainfall—regions which comprise not less than 700,000 square miles. Thus, we need consider only

the Queensland coastal margin backed by its comparatively small plateaux, and the wet-dry belt of monsoonal country running inland from the North and North-west coast. Australians should never forget that these two regions are of entirely different character. The Queensland coast and plateaux are really promising, for they possess patches of excellent soil and a good and well-distributed rainfall from the monsoons and south-east trades. The Northern and North-western coastlands are entirely different. Most of the soils are poor, leached, and deficient in plant food. During six to eight months the country is almost drought-stricken. In summer, much of it is flooded by terrific rains, some of the rivers rising 50 or 60 feet.

Development of Our Tropical Territories.

Last time I explained how in the days before modern science the whites invaded the tropics, and how in almost every region their penetration failed. From 1824 onwards the whites entered the Australian tropics, partly as squatters and partly as agriculturists on the Queensland and Northern Territory coasts. From 1824 to 1849 the British planted small stations, such as Port Essington in North Australia, and South Australia founded and maintained the Northern Territory as a dependency from 1868 until in 1911, when the Commonwealth took control. From the sixties onwards Australia also saw the development of Northern Queensland by pasturing, agriculture and mines.

This tropical invasion took the usual course. The whites believed that it was impossible for them to work in the tropical climate, and they imported various coloured races which proved hotbeds for diseases that affected the whites in turn. From 1863 to 1891 Australians brought 46,000 Kanakas to Queensland, and from 1874 onwards the Northern Territory permitted the entrance of thousands of Chinese. Few people now realise that in 1876-7 the Japanese Government emphatically refused an official offer by South Australia for an extensive Japanese settlement in the Northern Territory, including free transport for the first 200 Japanese.

A Lost Opportunity.

This influx of coloured people to our continent had the same tragic results as in the West Indies and other parts of the world. We Australians, who had entered into possession of what might have been a marvellous biological laboratory of continental magnitude and free from the worst kinds of tropical sickness, brought in unhealthy types of coloured people who riddled the country and its white inhabitants with tropical disease. In the Northern Territory, during the seventies, white men and Chinese coolies died like flies, while in Queensland the "dreadful eighties" saw a Kanaka death rate four times as great as that of the white inhabitants, and a white mortality that became 50 per cent. greater than that of any other State. Yet, even in these circumstances, events showed the fundamental difference between Queensland and North Australia. In both regions pasturing and mining made progress, but while in Queensland the whites and Kanakas established sugar, cotton, fruit, and other tropical industries, in the Northern Territory with its seasonal rainfall, poor soil, isolation and pests, such as the white ant and rat, the whites and Chinese met with no success. The close of the century saw North Australia stagnant save for cattle, mining, and pearling, and for a plantation system of agriculture—as usual unhealthy—established on the Queensland coast.

A Scientific Invasion.

Yet, while the pre-scientific invasion failed in Australia as in other countries, a scientific invasion from 1900 onwards has made progress, as is the case in Panama and in Southern Florida, which latter is a moderately tropical region very like the Queensland coast. Under the much-criticised White Australia Policy the nation deported the Kanakas, and by a health campaign against hookworm, leprosy, malaria, and other diseases, made the health and vital statistics of Queensland as good, or better, than those of any other State. To the utter astonishment of the

scientists of all nations, we established a working population of 150,000 white people in North-Eastern Queensland—the largest population of working Nordics in any part of the tropics. There is, of course, the question of alien Italian penetration in the most northern sugar districts, and it is very significant that in these areas foreigners or naturalised subjects number no less than 43 per cent. The Sugar Committee of 1931 reported, however, that the flow of alien immigration had declined; that the problem was passing through a transitory stage; and that satisfactory communities would be evolved out of the communities in the far North. White Australians of British extraction have shown that they can do all the heavy labour in sugar and other industries, and before the depression they were bringing the costs of sugar production down towards the cost of production in coloured labour countries. In this respect, mechanical improvements will be of vast importance. In Florida and Jamaica I saw machinery which will eliminate almost all the hard manual labour in the sugar industry. While, however, this machinery will improve the prospects for white workers, it will spell stark naked tragedy for the wretched coloured peoples whom the white man has forced into one-crop industries.

Remarkable Physical Phenomena.

In 1924 a scientific investigation of certain Queensland towns disclosed remarkable phenomena. Contrary to all previous beliefs, white residents, even of the second and third generations, seemed to be healthy and strong. Tropical-born women averaged larger families than immigrant women from the cool temperate zone, and the most healthy people were those who did hard manual work. There remain two dangers in Queensland. First, the experiment is very new, and we are by no means certain of the continued effects of climate. Dr. Cilento considers that there is beginning to be a very definite type of North Queenslander or tropical-born Australian who moves slowly and conserves his muscular heat-producing energy in every possible way, but that this type is not lacking in muscular strength, while his endurance is equal in his own circumstances to that of the temperate dweller in his. Sir George Buchanan, in his great report on the Northern Territory, produced evidence to the effect that white labour there was from 10 per cent. to 35 per cent. inferior to that in the temperate zone.

The second danger in Queensland is that the white industries are uneconomic in the sense that their costs of production are far above world average, and that Australia is being forced to pay inordinately high prices for such products as sugar and bananas to allow the white population that standard of living which is essential if whites are to survive in the tropics. Yet, Queenslanders can justly argue that their industries are now no more uneconomic than most of the tariff-propped industries of temperate Australia. As Keynes and other economists confess, the tariff-mad and nationalistic nations are boxing themselves in water-tight economic compartments, and we must all face artificial industries and a lower standard of life.

Cattle-raising—A Probable Solution.

While the whites have succeeded in tropical Queensland, in the rest of North Australia, save in cattle, they have met with practically no success. It is a matter of sympathy that in the Northern Territory, for example, the figures of deaths, illegitimate births, serious crime, suicides, and drunkenness are far higher than those for any other division of the continent. Such figures are not necessarily due to the tropical climate, for isolation, a mixed population, poor diet, and frontier conditions take their toll from the unfortunate people. Nevertheless, it is significant that South Australia and the Commonwealth fruitlessly expended enormous sums of money in vain efforts to develop a huge area which now contains less than 4,000 whites. From 1911 to 1930 the Federal Government spent over £11,000,000, and in 1928-29 alone made a loss of £576,000, or about £150 per white person, while under Federal control the costs of working the Northern and Central railways

have exceeded the revenue by nearly 100 per cent. It is small wonder that American scientists, in a recent world survey, have pointed out the utter futility of Australia wasting vast sums in attempting to develop agriculture and close settlement in her North Coast lands of poor soil and uncertain monsoonal rains. The only real hope lies in the cattle country which runs across the continent from Queensland to Western Australia between the central deserts and the coastal regions. Here, on stock routes and water supplies, we should spend as much as we possibly can, and it is splendid to know that the motor transport unit, which the Federal Government is subsidising, may solve the railway problem, and is already reducing costs by 50 per cent.

Segregation of the Native Race.

Outstanding questions of North Australia are the aboriginal and half-caste problems. It is now generally recognised that we should try to segregate the blacks, where it is possible, for example, in Melville Island and Arnheim Land. As regards the thousands of aboriginals who have access to settled country, the best we can hope is to absorb them as the Americans have absorbed the Red Indians. It is interesting to note that a recent Vice-President of the United States was legally an Indian—a ward of the State. The Australian half-castes are now increasing at the rate of 800 per annum, and one believes that the Protector at Darwin is right in trying to marry these half-castes to one another, and the surplus girls to white people, rather than to force them back to the aboriginal camps.

Successful Tropical Settlement.

In conclusion, one would say that history and science provide the answer to those who ignorantly criticise our empty North and the policy of White Australia. The only parts of our tropics which any nation—white or coloured—can hope to settle closely are the coasts and highlands of Eastern Queensland, and here we have already planted successful white industries and a white population which is apparently teaching the most extraordinary and unexpected lessons to the whole world. The remainder of North Australia is at best a cattle country. We have poured out £17,000,000 in unsuccessful attempts to settle one portion—the Northern Territory. Agriculture, with coloured Chinese labour, has been an utter failure, and the Japanese very wisely refused our invitations when we invited them in. If, despite such a record, the Dean of Canterbury, or Dean Inge, or Mr. Beverley Nicholls continue their criticisms of our supposed selfishness, Australians might humbly ask them to visit the West Indies, and study, as I did recently, the tragic problems of race, health, and economics, which were created by the importation of negro slaves.

Scientific Research Demanded.

What is the practical lesson of these two addresses? It is that the Australian Governments of all parties should face their problems in the tropics, not as questions of politics, but of science, and that before more money is lost in attempts to plant white settlers and tropical industries they should prepare the way by careful scientific research. To take only one problem—that of agriculture in the Northern Territory—almost every one of the few soil analyses have been disappointing, and even black soil which I brought down from the Adelaide river flood plains proved deficient in potash. Yet, despite the advice of Sir George Buchanan, the Government, only a few years back, again attempted to foster by subsidy a one-crop peanut industry on soils which a later soil analysis proved unsatisfactory. We now know that adequate scientific work in the Northern Territory could have saved the nation a loss of millions of pounds, and the people of Australia have the right to ask that no more money be wasted without the most careful and impartial examination by highly-trained scientists.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Friesian Cattle Society, production charts for which were compiled for the month of October, 1934 (273 days period unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORN.			
	MATURE COW (OVER 5 YEARS), STANDARD 350 LB.			
Lucky II. of Windella	J. Phillips, Wondai	14,152·58	592·29	Daisy's Westbridge of Glenthorn
	SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.			
Springleigh Primrose 2nd	Moller Bros., Boonah	9,647·9	388·203	Red Knight of the Cedars
	SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.			
Champion 12th of Oakvilla (365 days)	H. Marquardt, Wondai	14,717·15	595·498	Victory of Greyleigh
	JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.			
Springleigh Buttercup 2nd	Moller Bros., Boonah	8,310·35	316·64	Red Knight of the Cedars
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD, 250 LB.			
Euroa Carnation	H. L. Lindenmayer, Binjour	7,272·5	265·244	Swagman of Clonogan
College Granny 4th	Queensland Agricultural High School and College, Gatton	6,500·22	253·936	Duplex of Greyleigh
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD, 230 LB.			
Lady Primrose 2nd of Blacklands	A. Pickels, Wondai	10,278·55	350·834	Fussy's Monarch of Hillview
College Buttercup 2nd	Queensland Agricultural High School and College, Gatton	6,475·18	333·449	Fussy's Kitchener of Hillview
Euroa Clorine	H. L. Lindenmayer, Binjour	7,174·75	265·599	Swagman of Clonogan
College Mayflower	Queensland Agricultural High School and College, Gatton	6,961·17	253·436	Premier of Hillview
Euroa Remona	H. L. Lindenmayer, Binjour	7,012·75	240·232	Swagman of Clonogan
College Molly 2nd	Queensland Agricultural High School and College, Gatton	5,543·99	237·021	Duplex of Greyleigh

JERSEY.

	MATURE (OVER 5 YEARS), STANDARD, 350 LB.			
G. N. Diva	Cox Bros., Maleny	6,876·6	433·551	Retford Mendels Noble
	SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD, 330 LB.			
Langside Quip (365 days)	G. W. Young, Inverlaw	8,335·75	512·856	Masterpiece Yeribee of Brucevale
Kelvinside Idol Tidy	J. & R. Williams, Crawford	6,353·75	428·403	Kelvinside Fleurs Benedictine
	JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD, 270 LB.			
Oxford High Girl	E. Burton & Sons, Wanora	6,086·76	324·005	Trinity Ambassador
Trecarne Rosette 3rd	T. A. Petherick, Lockyer	4,839·47	270·558	Trecarne Golden King
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD, 250 LB.			
Langside Pattibelle	G. W. Young, Inverlaw	5,365·65	279·754	Masterpiece Yeribee of Brucevale
Brooklands Forward Lillian	Wallace Bishop, Kenmore	5,546·5	271·443	Forward of Brooklands
College Rhoda	Queensland Agricultural High School and College, Gatton	4,443·02	255·286	College Silverside
Langside Thelma	G. W. Young, Inverlaw	4,968·1	248·957	Masterpiece Yeribee of Brucevale
College Florette 2nd	Queensland Agricultural High School and College, Gatton	4,141·3	241·826	Burnside Renown

FRIESIAN.

	SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD, 330 LB.			
Ryfield Maggie 2nd	J. P. Larson, Miriam Vale	9,868·25	383·988	Ryfield Butterman 3rd
Ryfield Dinah 4th	J. P. Larson, Miriam Vale	8,832·	379·446	Ryfield Butterman 3rd
	SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD, 290 LB.			
St. Athans Honeysuckle	W. H. Grams, Upper Tent Hill, Gatton	8,637·98	326·6	Glenvale Dutch Oak
	JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD, 270 LB.			
Rockview Hope	J. P. Larson, Miriam Vale	6,576·	283·854	Noreens Dekol
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
St. Athans Double Dutch	W. H. Grams, Upper Tent Hill, Gatton	7,205·33	254·410	Glenvale Dutch Oak

AGRICULTURE ON THE AIR.

Radio Lectures on Rural Subjects.

Arrangements have been completed with the Australian Broadcasting Commission for the regular delivery of further radio lectures from Station 4QG, Brisbane, by officers of the Department of Agriculture and Stock.

On Tuesdays and Thursdays of each week, as from 3rd January, 1935, a fifteen minutes' talk, commencing at 7.15 p.m., will be given on subjects of especial interest to farmers.

Following is the list of lectures for January, February, and March, 1935:—

SCHEDULE OF LECTURES

BY OFFICERS OF THE DEPARTMENT OF AGRICULTURE AND STOCK, RADIO STATION 4QG, BRISBANE (AUSTRALIAN BROADCASTING COMMISSION).

Thursday, 3rd January, 1935—"Rose Culture," by H. Barnes, Director of Fruit Culture.

Tuesday, 8th January, 1935—"Some Notes of a Travelling Scholar in Plant Breeding," by Dr. L. G. Miles, Plant Breeder.

Thursday, 10th January, 1935—"Improving the Quality and Productiveness of Fruit and Fruit Trees," by H. Barnes, Director of Fruit Culture.

Tuesday, 15th January, 1935—"The Place of Plant Breeding in Agriculture," by Dr. L. G. Miles, Plant Breeder.

Thursday, 17th January, 1935—"The Trend of Agricultural Economics," by Hon. Frank W. Bulcock, M.L.A., Secretary for Agriculture and Stock.

Tuesday, 22nd January, 1935—"The Problem of Youth—The Call of the Land," by J. F. F. Reid, Editor of Publications.

Thursday, 24th January, 1935—"A New Deal for the Farmer," by J. F. F. Reid, Editor of Publications.

Tuesday, 29th January, 1935—"Frost Prevention by Orchard Heating," by H. Barnes, Director of Fruit Culture.

Thursday, 31st January, 1935—"Wheat in Queensland," by H. W. Ball, Assistant Experimentalist.

Tuesday, 5th February, 1935—"The Rural Revival in Britain—What it Means to the Australian Producer," by J. F. F. Reid, Editor of Publications.

Thursday, 7th February, 1935—"Grading Cotton," by R. W. Peters, Cotton Experimentalist.

Tuesday, 12th February, 1935—"Winter Legumes and other Fodders," by C. T. White, Government Botanist.

Thursday, 14th February, 1935—"Some Notes on Our Inland Pastures," by S. L. Everist.

Tuesday, 19th February, 1935—"Management of Paspalum Pastures," by C. W. Winders, B.Sc. (Agric.).

Thursday, 21st February, 1935—"The Cultivation of Lucerne," by A. E. Gibson, Director of Agriculture.

Tuesday, 26th February, 1935—"The Effects of Fertilizers on the Quality of Tobacco Leaf," by W. J. Cartmill, B.Sc.

Thursday, 28th February, 1935—"Snapping Cotton," by R. W. Peters, Cotton Experimentalist.

Tuesday, 5th March, 1935—"The Activities of Sheep and Wool Branch with Special Mention of the Farmers' Wool Scheme," by J. L. Hodge, Instructor in Sheep and Wool.

Thursday, 7th March, 1935—"Sheep Licks," by J. L. Hodge, Instructor in Sheep and Wool.

Tuesday, 12th March, 1935—"Winter Pastures," by C. W. Winders, B.Sc. (Agric.).

Thursday, 14th March, 1935—"Grape Culture," by H. Barnes, Director of Fruit Culture.

Tuesday, 19th March, 1935—"Some Remarks on Animal Nutrition," Part I., by E. H. Gurney, Agricultural Chemist.

Thursday, 21st March, 1935—"Some Remarks on Animal Nutrition," Part II., by E. H. Gurney, Agricultural Chemist.

Tuesday, 26th March, 1935—"Observations on Tobacco Fertilizer Trials," by W. J. Cartmill, B.Sc.

Thursday, 28th March, 1935—"Expanding our Export Trade," by J. F. F. Reid, Editor of Publications.

NOTICE TO SUBSCRIBERS.

SPECIAL AND IMPORTANT.

Under the Commonwealth Postal Regulations it is NO LONGER PERMISSIBLE to indicate the expiry of subscriptions with a BLUE CROSS on the first page of the Journal. So in the future that reminder will NOT appear.

The need for the strictest economy makes any other form of reminder at present impracticable. THE ONUS OF REMEMBERING THE DATE OF EXPIRY OF, AND RENEWING THE SUBSCRIPTION PROMPTLY IS, THEREFORE, PLACED ON EACH SUBSCRIBER.

As about 1,000 subscriptions expire each month, the cost of a postal reminder is, in present circumstances, prohibitive. Readers will, therefore, appreciate that fact, and will, no doubt, help us to retain their names on our mailing list by kindly noting the date of payment of their subscriptions and, on expiry, sending in their renewals at once.

Instead of just sending the annual subscription—one shilling—along, it is suggested that, when renewing, they do so for two or three years, or even a longer term. For instance, FIVE SHILLINGS would keep a name on our subscribers' register for FIVE YEARS.

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Readers renewing their subscriptions should USE THE ORDER FORM on another page, which should be filled in FULLY and CORRECTLY. Renewals by letter do not as a rule give the essential information, thereby causing unnecessary waste of time and much inconvenience. The Form is also our record, and orders which come by letter require special handling to adapt them to our card recording system.

When an address on the Order Form is not that to which the Journal has hitherto been sent, attention should be called to the new address, and the former address given. This assists us to identify subscribers, of whom we have many of the same name, often in the same district, as well as in different parts of the State.

Women subscribers should add to their names the word "Mrs." or "Miss," as the case may be. This is a constantly recurring omission, and its correction causes a lot of unnecessary labour in checking electoral rolls and other references. Wives and children of subscribers should apply in the subscriber's name, and so facilitate registration.

PLATE 317.

Stock-proof Fence and Ringbarking on a Selection in the Roma District.

[*Photo., J. A. Lunn.*

Plate 318.

Silky Oak in Plantation, showing First Thinning. Trees ten years from planting.

[*Photo., J. A. Lunn.*

PLATE 319.

A Queensland Kauri Pine Plantation, seventeen years old. This species makes a good plantation tree, and is used to the greatest extent permitted by seed supplies, which are difficult to obtain.

[*Photo., J. A. Lunn.*

PLATE 320.—GIDGEE, BRIGALOW AND BELAH COUNTRY, SOUTH WESTERN QUEENSLAND.

[Photo.

PLATE 321.—BRIGALOW AND BELAH COUNTRY, BEFORE RINGBARKING.

[Photo., J. A. Lunn.

Plate 322.—Heavy Coating of Grass on Country Ringbarked Two Years Ago, Maranoa District.

[Photo. by J. A. Lunn.

PLATE 323.—NATURAL REGENERATION OF IRONBARK (*E. paniculata*), SHOWING FIREBREAK.

[*Photo. by J. A. Lunn.*

PLATE 324.—FORESTRY IN QUEENSLAND.—PLANTATION OF TALLOWWOOD (*Euc. microcorys*) FOUR YEARS OLD.

[*Photo. by J. A. Lunn.*

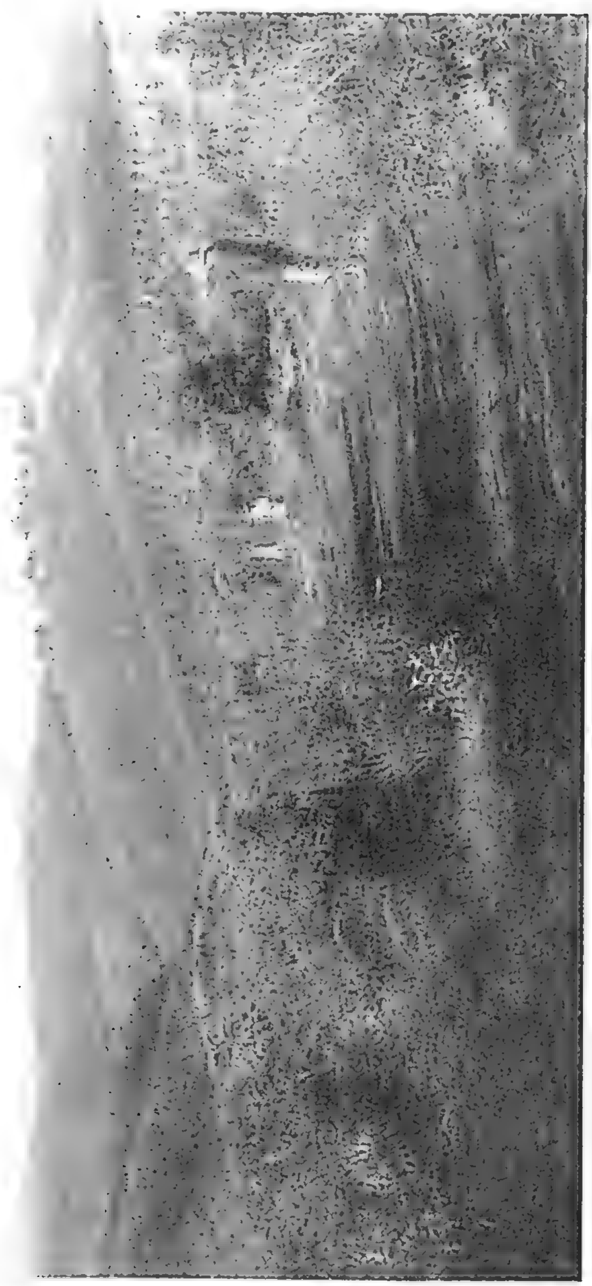

PLATE 325.—A SECTION OF BRISBANE VALLEY DISTRICT FORESTRY PLANTATIONS.

[*Photo. by J. A. Lunn.*

PLATE 326.—CLEARING LINE FOR A MARSUPIAL-PROOF FENCE THROUGH BRIGALOW AND BELAH SCRUB IN THE TARA DISTRICT.

[*Photo. by J. A. Lunn.*

PLATE 327.—HOOP PINE PLANTING STOCK IN NURSERY, SUB-DEPARTMENT OF FORESTRY, QUEENSLAND.

[*Photo. by J. A. Lunn.*

PLATE 328.—YOUNG HOOP PINE PLANTATION, SEVEN YEARS OLD.

[*Photo., J. A. Lunn.*

ALOW AND BELAH SCRUB BURNED EIGHTEEN MONTHS AGO NOW CARRYING A HEAVY COATING

[Photo., J. A. L.

Answers to Correspondents.

BOTANY.

Replies selected from the outward mail of the Government Botanist, Mr. Cyril White, F.L.S.

Poisonous Plants Identified.

H.C. (Mackay)—Your specimens have been determined as follows:—

1. *Crotalaria* sp., a species of Rattlepod. All these plants are to be looked on with suspicion, although, generally speaking, our experience in Queensland is that stock rarely touch them in sufficient quantities to cause trouble.
2. *Lantana camara* var. *sanguinea*, the Red Lantana. Very abundant in parts of Queensland, and causes the trouble known as "Pink Nose," no doubt familiar to you.
3. *Trema orientalis*, a close ally of the Poison Peach or Peach-leaved Poison Bush. The present form grows into a medium-sized tree, and is very common in coastal localities. We have not heard of it causing trouble in any way, therefore do not think this plant can be looked on as the cause of the trouble in this case.
4. *Asclepias curassavica*, Red Head or Milky Cotton-bush. A very common weed in many parts of Queensland. It is poisonous, though, on the whole, our experience has been that stock rarely eat it in sufficient quantities to cause trouble.
5. *Clerodendron floribundum*. A shrub or small tree common in parts of coastal Queensland. We have not heard a common name applied to it. It is not known to be poisonous or harmful in any way.
6. *Glochidion Ferdinandi*. A small tree very common in coastal Queensland, particularly as second growth in paddocks. It is not known to be poisonous or harmful in any way. We have not heard a very distinctive local name for it.

Of the above plants Nos. 1, 2, and 4 come under suspicion, and, if possible, should be eradicated from the property.

"The Tree of Heaven."

C.B. (Pine Mountain)—

The shrub contained neither flowers nor seeds, but we think there is no doubt it represents *Ailanthus glandulosus*, the "Tree of Heaven." The bark and roots contain a poisonous principle and this probably extends to the leaves; although the tree is very common in cultivation and has run out in some places, we can find no reference, either in Australia or abroad, to the leaves having proved harmful or poisonous to cattle. In view, however, of the known poisonous character of the plant it would be just as well to eradicate it from places to which cattle have access. The poisonous properties of the plant are said to be a cause to a great extent of chronic gastritis. Vomiting, pains in the back, difficult urination, and persistent constipation are said to be features of Ailanthus poisoning.

Flame Tree.

E.H. (Childers)—

The specimen represents the Flame Tree (*Sterculia acerifolia*), a native of Northern New South Wales and coastal Queensland. It is moderately common in come coastal rain forests or vine scrubs, and when one is at a height such as Tamborine Mountain and the McPherson Range, looking down on the valleys at this time of the year one can see bright patches of colour where this tree is in flower. It is certainly an exceedingly handsome tree, but it varies a lot in its flowering qualities. Some trees at the present time of the year are one mass of flowers, others have somewhere about an equal proportion of flowers and leaves, and others are bearing practically all leaves and very few flowers.

Wild Verbena.

INQUIRER (Brisbane)—

Your specimen represents *Verbena venosa,* commonly known in Queensland as the Wild Verbena, a native of the Argentine, now a common naturalised weed in many parts of Queensland and New South Wales. It seems to have been much on the increase in Queensland during the last two or three years, and along many roadsides and railway lines we have seen it crowding out other plants and grasses. If it is invading the native pasture in the Burnett district it is certainly serious, as it is a very dominant weed and would eventually run out the grasses and pasture plants—practically speaking, ruining the paddocks.

Plants from Winton District Identified.

R.C. (Winton)—

1. *Sporobolus actinocladus,* a common grass in parts of Western Queensland. We have not heard a common name applied to it.
2. *Goodenia glauca* (?). Better material required to be certain. Species of Goodenia are quite common in Queensland, both on the coast and inland. They are probably quite useful herbs in the mixed native pasture, though we cannot say we have actually seen stock eating them to any extent.
3. *Chloris scariosa.* One of the Star grasses or Windmill grasses. A very pretty species, though we have not heard a distinctive name given to it.
4. *Capsella Bursa-pastoris,* Shepherd's Purse. We note you say that this plant has just appeared in your locality. It is very common in Queensland, but mostly occurs as a farm weed. It belongs to the family Cruciferae which contains the Turnips and Mustards, and like other members of that family, if eaten in quantity by dairy cattle, it taints milk very badly.
5. *Abutilon* sp., a plant of the Mallow family. The genus Abutilon is a fairly large one in Queensland, and the members are rather difficult to determine except with very complete material. The genus, we think, is rather in need of revision.
6. *Bassia* sp., Gidgee Prickly Saltbush.
7. *Euphorbia Stevenii,* Bottle Tree Caustic. This is generally regarded as poisonous, though so far as we know actual feeding tests have not be carried out with it. The characters of Euphorbia poisoning as recorded by practical stockmen, both in Queensland some of the other States, are that the head and neck of affected animals swell very considerably, and if this swelling is pierced an amber-coloured fluid exudes. If pierced in time the life of the animal is usually saved.
8. *Helichrysum podolepideum.* A fairly common weed in parts of Western and Central Queensland. It is not known to be poisonous or harmful in any way.
9. *Pterigeron adscendens.* This and an allied plant have been suspected of poisoning stock, but no feeding tests have been carried out with them. Chemical analysis in most of these cases yields very little result, and the only way of finding out whether these plants are poisonous or not is by means of feeding tests.
10. *Capparis nummularia,* a plant of the Caper family. It is not known to be poisonous or harmful in any way. I have never heard it called Fuchsia Bush. It is a pity to call it Fuchsia Bush as this confuses it with another plant—namely, *Eremophila maculata,* with red, or more rarely yellow, spotted flowers. This latter is probably familiar to you. It is undoubtedly poisonous, containing a prussic acid yielding glucoside, but like other prussic acid yielding plants it is sometimes eaten in large quantities without any ill effects following. The effects of plants of this character are most marked on tired or travelling stock.
11. *Scaevola* sp. Could you send better material of this species, pressed if possible? We do not seem to have it in our collections.
12. *Swainsona Burkei,* Ladies' Pockets. Another interesting plant. Would it be possible to send fruiting material of this?
13. *Trichodesma zeylanicum,* Kangaroo Bush. We have never seen stock eat this, although they may nibble at it at times. The plant has been suspected of being poisonous, but we think on insufficient evidence.

Chaff Burr.

Inquirer (Winton)—

The specimen represents *Achyranthes aspera,* the Chaff Burr or Prickly Chaff Flower, a weed widely spread over tropical and sub-tropical parts of India, the Malayan region, Australia, and the islands of the Pacific. It is quite common in parts of Queensland and ranges from the sea beach to the far interior. Though its prickly fruits seem to lend themselves to distribution, we cannot say that we have seen the plant anywhere as a serious pest. In India the plant is looked upon as highly medicinal, being used in the treatment of various diseases. The leaves, like those of other members of the Amaranth family (Amarantaceæ) in the East, are sometimes used as greens. The plant does not possess any poisonous properties and would probably be eaten by stock, although we have had no experience with it in this direction.

Plants from Cairns District Identified.

J.A.H. (Cairns, N.Q.)—Your specimens have been determined as follows:—

Flannel Weed, *Pterocaulon cylindrostachyum.* The name Flannel Weed is mostly applied in North Queensland to a rather different plant—a species of Sida, namely *Sida cordifolia.* We know of no economic uses for either of them except that the Sida plant is said to be readily eaten by stock, although the numerous hairs with which it is covered might cause digestive troubles.

Scented Weed, *Pterocaulon glandulosum.* We note what you say about this plant being a possible repellent for insects. See notes under next specimen.

Camphor Weed, *Hyptis suaveolens.* A very common weed in North Queensland, a native of tropical America. It was first noticed about Townsville some twelve years or so ago, but is now very abundant through the whole of the North. The stems and leaves are sometimes strewn around themselves by fishermen, who state that the plant has a definite value for keeping away the attacks of sand flies, mosquitoes, and other insects. If the oil were distilled from this plant, it would probably have somewhat the effect of citronella and be merely a repellent. We do not know that it would have any definite lethal properties; this could only be tried by experiment.

Native tree, said to be quite ornamental and good for bees, is *Persoonia falcata,* one of the Geebungs.

Corky Bark, *Coelospermum reticulatum,* a native tree very common in many places, widely distributed in Queensland, but for which we have not heard a definite local name.

Yam, *Dioscorea bulbifera* var. This we think is the common ornamental yam grown in Queensland. Have you ever tried eating them? We once wrote to Mr. Burkill, when he was Director of the Botanic Gardens at Singapore. He is a great authority on yams and we asked him about the varieties of *Dioscorea bulbifera.* He said they varied very considerably in regard to their edible qualities from pleasant to dangerous. Cutting the yams open and seeing if they turn brown quickly or not he regarded as quite a good sign. When in doubt his advice was to cook in small quantities and taste discreetly.

Perennial Rye.

J.M.C. (Condamine)—

The specimen has been determined as the Perennial Rye (*Lolium perenne*). This, we think, is undoubtedly the best of the Rye Grasses owing to its perennial character. So far as our experience in Queensland goes, however, it does not seem to have succeeded outside of cultivated areas. However, we think it well worth trying with the Burr Trefoil and White Clover on your box and sandalwood country. The addition of the superphosphate you are using should certainly increase the clover and trefoil content of the pasture. Did the grass grow through last summer with you or did it die out and come again this year? Even the true perennial strains of Rye Grass, we are inclined to think, may die out in the Queensland summer, particularly when the plants are pastured, although they may come again the following season. Have you tried the perennial strain of Prairie Grass (*Bromus marginatus*)? Seeds of this and the Rye Grass are best sown during the autumn months.

Gympie District Plants Identified.

E.R.L. (Lagoon Pocket, via Gympie)—

Your specimens have been identified as follows:—

1. *Medicago denticulata,* the Burr Trefoil, a very valuable winter and early spring fodder. Stock seem to prefer the plant when it is dying off rather than when it is green and luxuriant, but even the dried plant covered with its little seed-pods is quite nutritious. The burrs that follow the seed-pod are rather objectionable in the belly wool of sheep, but the good qualities outweigh the bad.
2. *Solanum nigrum,* the Black Nightshade, called "Blackberries" by children. The plant, however, is not related in any way to the true Blackberry. The green fruits contain a poisonous alkaloid, solanin, which tends to disappear as the fruits ripen up. Hence the ripe fruits are freely eaten by children without any ill-effects following.
3. *Stachys arvensis,* commonly known as Stagger Weed or Wild Mint. It is not to be confused with the Wild Mint that has attracted so much attention in the Press of recent years, and is a bad weed on parts of the Darling Downs. The present plant, as its name indicates, causes "staggers" or "shivers" in working stock. Ordinary paddock or resting stock, however, feed on the plant with impunity, and for dairy cattle, calves, &c., it is quite a good fodder.
4. *Silene gallica,* French Catch-fly, a native of Southern Europe, now a common naturalised weed in most warm temperate countries.
5. *Erythræa australis,* Centaury, a plant of the Gentian Family (*Gentianæ*); used by many people as a tonic.
6. *Euphorbia peplis,* Spurge. The milky sap that this plant contains is sometimes used for drying up sores, and is said to have curative properties.
7. *Trifolium procumbens,* Hop Clover. An annual Clover; a native of Southern Europe now naturalised in most warm temperate countries. It is moderately common in Southern Queensland during the winter and spring months, dying out on the approach of summer.
8. *Striga parviflora.* Plants of this genus are mostly parasitic on grasses. Some of the species are quite common in Queensland as parasites of sugar-cane.
9. *Trifolium glomeratum,* Cluster Clover. One of the best of the annual Clovers and worth encouraging.

W.G.B. (Amamoor, Mary Valley Line)—

1. *Fumaria officinalis,* Fumitory. A common European weed now common as a naturalised alien in most temperate countries.
2. *Chenopodium triangulare,* Fish Weed, a native plant of the Saltbush Family. It is a very common weed in many places. Stock seem to eat it readily enough when it is dying off and made into hay, though they do not eat the growing plant very much as a rule. It is said to be quite good fodder, but gives a peculiar fishy flavour to milk and cream; hence the local name.
3. *Richardsonia brasiliensis,* a native of South America. It is sometimes called Mexican Clover, though it does not belong to the Clover Family, and is indeed botanically far removed from them. In other countries it has been highly spoken of as a fodder, but our experience in Queensland is that stock practically never touch it. It is rather a bad weed in some of the fruit farms on the North Coast Line.
4. *Rumex Brownii,* Native Dock.
5. *Apium leptophyllum,* commonly called Wild Carrot or Carrot Weed. It is eaten by stock, but gives a strong flavour to milk and cream.
6. *Chenopodium carinatum,* a strong-smelling weed for which we have not heard a common name.
7. *Anagallis arvensis,* the Scarlet Pimpernel, a common European weed now abundant in Queensland and the southern States. It is recorded as poisonous, but is mostly left untouched by stock. Some years ago, however, we received a number of seeds from the paunch of a cow that had been poisoned at Buderim Mountain, evidently through eating this plant. Dr. Gilruth has also recorded poisoning of sheep in Victoria through it.
8. *Stellaria media,* Chick Weed.

Galvanised Burr.

A.E.G. (Brisbane)—

Galvanised Burr (*Bassia Birchii*) is a native of Western Queensland and Western New South Wales. It is not an introduction, but has spread of recent years to an alarming extent especially along stock routes and in heavily stocked country. This is due to the grasses and more palatable herbage being eaten out, leaving this burr to reproduce freely. It sets an enormous quantity of seed, starting to seed at a very early stage and continuing till the end of its life. A plant probably lasts for two years, perhaps a little more. The burrs are spiny, a burr is borne in practically every leaf axil, and each contains a single seed.

The only method of eradication that has been practised successfully so far as we know is the costly one of hoe chipping. We are rather doubtful as to whether arsenical and other sprays would have very much effect on the plant, and their use in ordinary pastoral country is always attended with some risk. The plants, we think, are very brittle; perhaps if you are acquainted with them you could think of some mechanical means of control.

Plants and Shrubs Suitable for the Hughenden District.

H.C. (Brisbane)—

Following is a list of shrubs and other garden plants suitable for the Hughenden district:—

Most of the summer annuals, provided water is available, should do very well there, particularly hardy plants such as zinnias; in fact, the only ones that would probably be difficult to grow are asters, and unless unlimited attention can be given to these, their cultivation, we think, would be hardly worth worrying about. Of perennial flowers, probably the best to grow would be gerberas. The perennial calliopsis or coreopsis would be excellent, and would probably grow almost like a weed.

Of shrubs, the best type to grow is something subtropical. The various sorts of acalyphas should do quite well, although, unless in protected situations, they might be a bit tender during the winter months. Here is a list:—

Abutilon; any varieties.

Franciscea; flowers blue, turning white.

Crotalaria (Bird Flower).

Hibiscus. There is a multiplicity of varieties of these, and they are probably about the best things to grow as shrubs in the Hughenden district.

Jasminum. Several Jasminums would do. Probably the best would be *Jasminum grandiflorum.*

Lagerstrœmia; any of these would do.

Lasiandra; worth trying.

Murraya.

Oleanders. A great range of these in bright colours can be obtained. They are among the best of the flowering shrubs for the Hughenden district.

Ochna; yellow flowers followed by black fruits seated on a bright red receptacle.

Frangipanni; both the red and white varieties would do well there.

Rhaphiolepis; Indian Hawthorn.

As regards climbers, the best plants would probably be the Bougainvilleas. If your friend has time in passing through it would pay him to visit the Botanic Gardens at Townsville, and have a talk with the Curator of the Gardens, Mr. Johnson, who might be able to supply him with some of the plants.

Milk Thistle.

H.A.J. (Ayr, N.Q.)—

The specimen represents the Sow Thistle or Milk Thistle (*Sonchus oleraceus*), a species of thistle widely distributed over the warm temperate and tropical regions of the world. In Java the thistle is commonly used as a herb, the leaves being steamed and eaten with rice. In Queensland the milk thistle is much prized as green feed for caged birds. It is also said to have valuable tonic properties for horses, and is commonly much sought after by trainers on this account.

The Date Palm.

Inquirer (Brisbane)—

Date Palms can be propagated either from seeds or suckers. Seedling plants come up quite freely in Queensland, often accidentally, and in some cases produce quite good dates. The male and female flowers in the date, however, are borne on distinct plants, and if you want to be certain of the sex, propagation must be from suckers. Unfortunately, the suckers do not root too readily, and even with a good deal of care there is always a certain number of losses; in fact, some authorities state that it is impossible to grow dates from suckers without a 50 per cent. loss. One could render the planting more satisfactory by banking up the earth around the sucker and inducing it to form roots while still on the parent plant. To ensure the best dates, the female flowers must be hand-fertilized, or at least partly hand-fertilized. This is usually done by opening the nearly ready male spathe, taking out a few male flowers, hanging them among the females, allowing them to open and the wind to scatter the pollen.

Shelter Trees.

J.L. (Goomeri)—

Some of the pines are good trees to plant as shelter for the cattle. Some of the true pines such as the Insignus Pine (*Pinus radiata*) or Long-leaved Pine (*Pinus longifolia*) should suit your purpose. Both these species are stocked by leading nurserymen. A pine that the Forestry Department is planting extensively at the present time, and which they say is giving good results, is *Pinus tæda*, the Loblolly Pine. Another tree that would do well is the Torulosa Pine (*Cupressus torulosa*). These may be purchased from nurserymen, either as seedling plants or plants raised from cuttings. The latter are more expensive, and for your purpose the seedling trees would suffice. This pine varies a little in shape, and if trees of a uniform character are desired it is better to get them raised from cuttings. The plants could be put in at the present time, although it is rather late. Get in touch with the Secretary, Sub-department of Forestry, Department of Public Lands, Brisbane, who might be in a position to supply you at a reasonable rate with Tæda or Loblolly Pines from their nearest nursery.

Button Burr.

A.C.W. (Capella, C.Q.)—

The specimen is the Button Burr (*Sida platycalyx*), a native of the Northern Territory, Central Australia, and parts of Western Queensland. We have from time to time received samples of this disc-like burr taken from wool received from Western Queensland. So far as we know, the burr is not growing naturally in your district, but if it were introduced it might become a bad weed. Fortunately, however, so far it has not shown any great tendency to spread, because, though it must be present in the wool of sheep from the far West, it does not seem to have spread east of the far western parts of the Warrego and Maranoa districts.

Ellangowan Poison Bush.

C. (Wandoan, Q.)—

The specimen has been identified as *Myoporum deserti*, the Ellangowan Poison Bush, a very common shrub in parts of Queensland. It was suspected for many years as a plant poisonous to stock, and recent feeding tests carried out at the Glenfield Veterinary Research Station, New South Wales, proved definitely the poisonous nature of the plant. Acute constipation and inflammation of the digestive tract are features of Myoporum poisoning. Most of the cases of trouble from this plant that come under our notice occur in travelling stock.

Shepherd's Purse.

C.McG. (Brisbane)—

The specimen forwarded represents *Capsella Bursa-pastoris*, the Shepherd's Purse, a common European weed now naturalised in most temperate countries. It is a very common weed in Southern Queensland. It is not known to be poisonous or harmful in any way, but like most members of the family *Cruciferæ* would taint milk very badly if eaten by dairy cattle to any extent.

General Notes.

Staff Changes and Appointments.

Constables W. Borghardt (Tewantin) and J. Kann (Kilkivan) have been appointed also Inspectors under the Slaughtering Act.

Messrs. W. Miller and W. Irwin, gatekeepers at the Buchan's Point Toll Gate and Third Beach Toll Gate, Cairns-Port Douglas road, have been appointed Honorary Rangers under the Native Plants Protection Act.

Miss M. A. Lyle has been appointed Assistant Cane Tester at the Kalamia sugar Mill as from 30th October, vice Mr. H. McAntee, resigned.

The Officer in Charge of Police, Malanda, has been appointed also an Acting Stock Inspector at that place.

Messrs. F. C. Coleman (Dairy Inspector, Pittsworth) and W. Dixon and H. J. D. McBean (Stock Inspectors at Goondiwindi and Millmerran) have been appointed also Inspectors under the Diseases in Plants Acts.

Sergeant W. Peters, Thursday Island, has been appointed also an Inspector under the Slaughtering Act.

Mr. J. A. Murray, Police Magistrate, Maryborough, has been appointed Chairman of the Mount Bauple and Maryborough Local Sugar Cane Prices Board, vice Mr. J. M. Bracewell, Police Magistrate, Gympie.

Acting Sergeant A. B. Brown (Biggenden) and Police Constables P. Byrne (Adavale), W. J. Cronau (Coomera), J. E. Wilson (Port Douglas), F. R. Nolan (Miriam Vale) have been appointed also Inspectors under the Slaughtering Act.

The Officer in Charge of Police at Cooyar has been appointed also an Acting Inspector of Stock at that place.

Messrs. H. Valentine (Bourbon Estate, South Bundaberg), W. G. Smith (Millbank, West Bundaberg), and A. Howe (Perry street, North Bundaberg) have been appointed Honorary Rangers under the Animals and Birds Acts.

Mr. A. P. Donnelly has been appointed Canegrowers' Representative on the Farleigh Local Sugar Cane Prices Board, vice Mr. H. G. Mulherin, resigned.

Messrs. A. R. Betts (Boonah) and R. J. O'Sullivan (Albion, Brisbane) successful candidates at the recent examination for Stock, Slaughtering, and Dairy Inspectors, have been appointed Inspectors under the Diseases in Stocks Acts, the Slaughtering Act, and the Dairy Produce Acts, Department of Agriculture and Stock.

Acting Sergeant W. R. Hennessy (Goombungee) has also been appointed an Inspector under the Slaughtering Act.

Messrs. Ross Nott (North Adelaide) and A. L. Clay (Bondi, N.S.W.) have been appointed Government Veterinary Surgeons, Department of Agriculture and Stock.

The Price of Bananas.

Queensland banana-growers are acutely conscious of the low prices prevailing for their fruit on the local and Southern markets, remarked the Minister for Agriculture and Stock (Hon. F. W. Bulcock, M.L.A.) recently. He had asked for a report on the matter, and it appeared that the large area which had been planted up in New South Wales and now in bearing, was chiefly responsible for such a big increase in production. It did not appear likely there would be any improvement in prices in the immediate future, for we were about to enter our season of heaviest production. A study of the daily market reports in recent weeks showed that while reasonable prices were being returned for the higher grades prices for the minimum grade were very poor. One solution of the difficulty was for growers to concentrate on the production of higher grades. The Director of Fruit Culture (Mr. H. Barnes) had advised that if growers adopted a more intense system of pruning of bunches by removing the bottom two or three hands soon after the bunches were thrown, the size of the remainder of the fruit on the bunches would be correspondingly increased.

At present growers discarded the bottom first, and sometimes the second hands of most bunches at the packing-shed, because the fruit on such hands did not come up to the minimum size permitted to be marketed. It was sound cultural practice to prune any fruit tree with the object of getting better fruit, and at the present time particularly there was every reason why this rule should be applied also to bananas and the useless bottom hands cut away from the bunches at an early stage of growth, and the plant food which would ordinarily be used in the development of small fruit which would later be discarded directed into the upper hands of the bunches to produce larger fruit there.

In Memoriam.

CHARLES ROSS, F.R.H.S.

Mr. Charles Ross, one of the best known identities in the agricultural and horticultural life of the State, died on 2nd November. Mr. Ross, who was seventy-nine years of age, first learned the principles of horticulture in Yorkshire, England. He made further studies in temperate fruit culture in the open, and in tropical subjects under glass at leading establishments in the British Isles. When he landed in Brisbane, in 1878, he was engaged by the late Mr. Walter Hill, curator of the Botanic Gardens, as plant propagator. He later proceeded to the Darling Downs, where he designed, planted, and conducted extensive improvements in the orchards and pleasure grounds at Canning Downs and Strath Elbess, and was in charge of the first wheat experiments by the late Professor Shelton, at the former place. When the Government acquired the Hermitage State Farm, he was appointed the first manager in 1897, and during the first four years over 400 varieties of cereals were under observation. He was probably the first to discover canary grass (*Phalaris bulbosa*) growing on the Darling Downs. This grass is now recognised as among our best pasture plants, and extensive swards of it have been established, especially in the Southern States, where it has won a high reputation among stock owners. In 1901 he became manager of the Westbrook State Farm, where special features were made of fruit and vegetable culture. Mr. Ross commenced his last appointment in the Government service as Instructor in Fruit Culture in 1910, from which position he retired in 1921, having reached the age limit. In his capacity as Instructor in Fruit Culture his duties brought him into close contact with people throughout the State, and as his visits to the country frequently synchronised with the holding of local shows, at which his services as judge were eagerly sought, he became one of the best known experts of the Agricultural Department. For many years he also officiated as judge in the fruit and vegetable sections of the Royal National Exhibitions, Brisbane. In his younger days Mr. Ross was a familiar figure in the cricket fields of the Darling Downs. He was a member of the old Zingari Club in Warwick in the eighties and early nineties, and was then regarded as one of the finest wicketkeepers in the State. His passing is deeply regretted.

Vegetables for Export—New Bags must be Used.

Advice has been received from the authorities in New South Wales that vegetables exported from other States to New South Wales markets must be packed in new containers. The previous practice has largely been to use second-hand bags for vegetables such as pumpkins, carrots, parsnips, &c., but the use of such containers is now prohibited.

Another Tully Sanctuary.

Bellenden, the property of Messrs. Henry Brothers, near Tully, has been declared a sanctuary for the protection of native animals and birds.

Broom Millet Board.

An Order in Council has been approved under the Primary Producers' Organisation and Marketing Acts formerly extending the operations of the Broom Millet Board from 1st November, 1934, to 31st October, 1937.

An Order in Council giving notice of intention to extend the operations of the Board for a further term of three years was issued on 23rd August last, and a petition invited from growers on the question of continuance. No such petition was received.

Canegrowers' Roll.

For the purpose of Local and Central Sugar Cane Prices Boards elections, the electors' roll of canegrowers is compiled from lists of canegrowers furnished to the Central Board by millowners each season. It is now proposed to use an up-to-date list of assigned lands prepared by the Central Board in lieu of the roll as furnished by the millowners, and accordingly the Regulations under "*The Regulation of Sugar Cane Prices Acts,* 1915 *to* 1933," have been amended to make provision for the new form of canegrowers' roll.

Egg Board Election.

The following nominations for the annual election of five growers' representatives to the Egg Board for the year 1935 have been received:—

District No. 1 (Caboolture-Bundaberg)—
Ronald Benjamin Corbett (Woombye). Returned unopposed.

District No. 2 (Brisbane North-Redcliffe)—
Matthew Hale Campbell (Albany Creek).
Robert Auburn Chapman (The Gap, via Ashgrove).
Raymond Harrison (The Gap, via Ashgrove).

District No. 3 (Brisbane South-Cleveland)—
Christian Gisler (Wynnum).
Tom Hallick (Wynnum).

District No. 4 (Moreton)—
Johannes De Vries (Rosewood).
Heinrich Jacob Jurgensen (Moogerah).
Alexander McLauchlan (Boonah).

District No. 5 (Darling Downs)—
Walter Thos. Hughes (Middle Ridge, Toowoomba). Returned unopposed.

The present members are Messrs. Corbett, Hallick, McLauchlan, and Hughes. The position for District No. 2 was rendered vacant by the recent death of Mr. A. A. Cousner.

The date fixed for the return of the ballot-papers to the department is on or before the 29th December next.

Control of Grasshopper Plague.

The Executive Council has approved of a Proclamation and a Regulation under the Diseases in Plants Acts dealing with the control of the plague grasshopper. These prescribe the manner in which the pest shall be dealt with by the application of insecticidal mixtures, and provide for the appointment of supervisory committees in the shires to which the Proclamation and Regulation at present apply—namely, Waggamba, Inglewood, Pittsworth, and Millmerran. The occupier, or if there is no occupier, then the owner, of land in these shires is obliged to apply an insecticidal mixture in a prescribed manner on land infested with larval plague grasshoppers. A breach of the Regulation renders the person committing the breach liable to a penalty not exceeding £20, a similar penalty being prescribed for a false statement made in an application for the supply by the Department of Agriculture and Stock of the requisite insecticidal materials.

The Minister for Agriculture and Stock, Hon. F. W. Bulcock, pointed out that during the incidence of the first generation of grasshoppers much valuable control work was done by farmers and pastoralists. It was essential, however, that the grasshopper plague be fought on every holding on which it appeared; hence it had been considered desirable to acquire powers to deal with any member of the community who might not yet be alive to his responsibilities in this important matter.

The State Government was making very considerable quantities of the necessary insecticidal materials available free of charge, and stocks had been or were being established at Goondiwindi, Yelarbon, Whetstone, Inglewood, Texas, Pittsworth, Millmerran, Kooroongarra, Rocky Creek, and Mount Emlyn. Persons requiring to control the grasshoppers on infested properties could make application for insecticidal materials on the prescribed form, the application to be lodged with the officer, committee, or individual controlling the local stock of materials.

The Minister stated that the second generation of hoppers would commence emerging during the next week or two, and all farmers and pastoralists were urged to keep a very careful watch for such emergencies. Furthermore, they should realise that it was essential to apply the control measures during the early stages of the larval grasshopper's life while the pest was still concentrated in large numbers on or near the sites on which the hoppers had emerged from the eggs.

Covered Smut of Barley—A Correction.

It has been brought under notice that in the article on covered smut in barley in the Journal for March, 1934, the omission of the figure "0" from the fourth line of the first column of the table on page 239 makes it appear that Abavit B, 2 oz. per bus., was not tried in 1932. Actually it was included in the experiment, with very good results, the resultant infection being nil.

Rural Topics.

Fat Lamb Raising.

The scheme inaugurated by the Minister for Agriculture and Stock (Hon. F. W. Bulcock) last January is already giving results.

The first batch of lambs to come forward for open competition at the Abattoir were the property of Mr. R. Taylor, of Felton East. These lambs were sold on Thursday, 1st November, and it is gratifying to be able to state that the Southdown Cross lambs by the Department's loan rams topped the market. Lambs out of identical ewes by Dorset Horn rams and dropped under similar conditions came a very meritorious second. Experienced judges are of the opinion that the Dorset Cross lambs in this consignment were the heavier. This goes to prove the fashion at the present time existing for the Southdown Cross.

Officers of the Sheep and Wool Branch of this Department have lately inspected the greater number of farmers' flocks coming under the scheme, and from now on a steady stream of prime export lambs may be looked for up until January next.

Everywhere visited the lambs give promise of early development, and the figures compiled after the end of the selling season should prove valuable to the Department and highly instructive to the farmers.

The scheme has created a wide interest amongst farmers and, in addition to those farmers who already have rams, there is a waiting list of others desirous of getting rams should the scheme be extended.

It is not possible at this date to indicate the most successful crosses. Figures and conditions under which lambs were grown will have to be carefully studied subsequent to the end of the experiment.

It may, however, be stated that the experiment has proved highly successful, and in many cases farmers have already expressed their preference for certain of the British breeds.

Potato-growing as Part of a Mixed Farming Proposition.

Under the present economic conditions it was necessary that the unit cost of production be as low as possible, and the motto of potato growers should therefore, be, "not more acres, but more yield per acre," observed a special instructor in vegetable production of the New South Wales, Department of Agriculture, in the course of a recent address. It would perhaps be wise if potato-growing was considered more in the light of a mixed farming undertaking, particularly in conjunction with stock-raising, than as a one-crop farming venture.

The growing of fodder and grazing crops would be found of great advantage in improving the quality of the land for future potato crops. The maintaining of a satisfactory organic content in the soil was a matter of vital importance on potato areas, since the decomposed organic matter in the soil imparted a desirable texture. On many areas the lack of organic matter was very apparent, and such soils quickly compacted; should this happen shortly after planting of the potatoes low yields were certain. From recent United States experiments it would appear that the growing and turning under of maize crops the season previous to the potato crop was receiving increased attention. Maize had become popular owing to the large bulk of organic matter supplied to the soil. Full benefits from artificial fertilizers could only be expected in a soil which had a relatively high moisture-holding capacity, such as was imparted to the soil by the incorporation of organic matter, in conjunction with proper cultivation methods.

Imported Berkshires.

It is of interest in reviewing the progress of the Berkshire breed to note that recent importations of selected stock in this breed have quite remarkable overseas records. The Berkshire sows imported last year by Mr. Frank Bach, of Oakey, are typical. The champion Berkshire boar at the English Royal Show in 1934 is from the same stud as that from which Mr. Bach selected his champion sow, "Lenton Patience," and also the reserve champion at the English Royal is from the herd where his younger sow came from.

It is understood with a view to further strengthening his herd, Mr. Bach is now importing another animal, a specially selected Berkshire boar from one of the most noted studs in England. Such importations are of great value to the Berkshire breed in this country.

An Australian Harvester-Thresher.

Following is an interesting extract from the "London Morning Post," 23rd August, 1934:—A new harvester thresher has been introduced into England by Mr. Scott, of Knighton Manor, near Salisbury. It is called the Sunshine harvester, and is of Australian origin. It pushes its way into the crop by its own power. It does not require a tractor to pull it, and so avoids the necessity of mowing round the field, or running over the grain from the outside.

The Average Cow—"Better Fed than Bred."

Discussing the feeding of dairy cattle before the recent Illawarra and South Coast Agricultural Bureau Conference, Mr. H. Cox, of Kangaroo Valley, said that the average dairy cow was much better bred than fed, or, in other words, was not fed well enough to enable her to yield her potential production.

The ration should not only be sufficient and correctly balanced, but should also have variety, succulence, and palatability. A nutritive ratio of 1:6.3 (1 part of protein to 6.3 parts of carbohydrates and fats) was considered ideal. In these days of low prices of dairy products it was necessary to consider carefully all the costs of production. If the dairy farmer could grow lucerne and maize his farm should be self-supporting as far as fodder was concerned. If it was necessary to buy concentrates, then extra fodder should be grown for sale to compensate for the expense.

By the improvement of pastures a ration nearly balanced could be provided and one which would keep the cows in good health.

Mr. Cox suggested the following daily rations:—

Maize silage, 30 lb.; lucerne chaff, 16 lb.; maize meal, 5 lb.; nutritive ratio, 1:6.3.

Maize silage, 35 lb.; lucerne chaff, 8 lb.; maize meal, 5 lb.; bran, 6 lb.; nutritive ratio, 1:5.6.

Maize silage, 30 lb.; maize meal, 5 lb.; bran, 7 lb.; wheaten chaff, 10 lb.; nutritive ratio, 1:6.9.

Lucerne chaff, 15 lb.; wheaten chaff, 5 lb.; bran 6 lb.; maize meal, 2 lb.; nutritive ratio, 1:5.9.

How to Maintain Quality in Cream.

Absolute cleanliness is the first law in profitable dairying, and a substantial proportion of the remedies for common cream faults come under this heading. Following are some hints on other aspects of prevention:—

Cool all cream promptly after separating.

Do not expose cream or cans to the direct rays of the sun.

Deliver to the factory frequently—not less than four times weekly. Deliver daily in summer time.

If possible, send all the cream in the dairy on days of delivery; any left over should be kept as cool as possible.

Do not mix fresh cream with older cream until the former has been cooled. Give the whole an occasional stir to make the mass uniform, and stir at least four times daily.

Prevent cows from wading in stagnant water; udders of cows should be washed and wiped before milking.

At least once a day remove all cow droppings 100 feet from dairy, yards, and bails.

Never use milk from sick cows, or from cows too soon after calving.

Use clean, sound brushware only in cleaning utensils—never use cloths.

Use only smooth, well-tinned tinware and cans, with all seams soldered flush.

If possible keep cows away from rank or objectionably flavoured weeds. Feed cows at least two hours prior to milking—better still, feed just after milking.

Do not send a very small quantity of cream to the factory in a can of large capacity if any distance is to be travelled.

Have the engine outside the separating room, and extend the engine exhaust to blow clear of the building. Keep smoke away from the dairy, and all strong-smelling material out of the dairy. On no account use water that has been heated in the engine jacket for washing.

Do not use strong-smelling disinfectants in water for washing.

Young or Old Boars?—How Long may Service be Extended.

Replies from prominent pig breeders to a questionnaire by the "Pig Breeders' Gazette" were made as follows:—

> "Does an old boar produce as large and as strong litters as a young boar? If not, at about what age does he cease to do so?"

The general opinion seems to be that a boar is never too old so long as he is prolific and can produce constitutionally strong litters. The following were some of the replies received:—

"Really, it depends on constitution; some boars never seem tired. I castrated one nine years of age, four years ago, and am still regretting it and wishing him back. Others pack up at three years, or even earlier.

"As long as conception results from the service, my opinion is that the number and strength of the litter depend almost entirely on the dam."

"Much depends on the individual sire and his management. Some sires seem to go on for years—up to seven and eight—and to get vigorous, healthy litters, while others fail when three to four years old.

"A boar becoming bad-tempered may shorten his useful life, but a boar too young and too hard at the start of his work has the greatest limiting effect, while running him on free range with a bunch of sows is extremely wasteful.

"Between the litters of young, vigorous boars and old, vigorous boars there seems comparatively little to choose, the variations usually being attributable to factors other than age. It has been found that the use of a suitable service crate will often improve the size and strength of litters from an old boar."

"I do not think that it is either a question of age or the strength and size of his get that determines the usefulness of a boar; one thing that I am certain of, however, is the fact that it is impossible to lay down a hard and fast rule as to a limit of age at which he ceases to get good litters, also that anyone who makes a definite statement in regard to it is either lacking in experience or observation.

"One of the greatest factors in keeping a boar fit is to give him plenty of work, after he is mature; by plenty, I do not imply that it is wise to let him run with sows. His services should be controlled, and, if he is big and heavy, a crate should be used for him; and provided he is well fed with a suitable ration, containing a fair amount of protein, there is no reason why his litters should diminish in size or strength, even though he may be eight or nine years of age, whereas there are many boars, whether from mismanagement or from some constitutional weakness, which seem to lose their usefulness at half this age, or even less.

"I am confident that periods of rest from service are not conducive to the length of useful life of a boar, neither are they with regard to the size and strength of litters. It is owing to this fact, I am inclined to think, that we breeders so often get rid of our second string stock boar before he has had a real chance to prove his worth."

A Travesty of North Queensland.

The writer of a recent work of fiction has chosen the surroundings of a North Queensland sugar mill as the venue of his story of the life of an Australian born of Italian parents. With the quality of the book as a whole we are not here concerned; but what needs emphatically to be stated is that as a picture of life in any part of Queensland, north or south, it is distinctly and dangerously misleading. One of its Melbourne reviewers has hailed it as "an accurate picture of a typical small town in the Queensland sugar belt," and "as showing us a glimpse of a hitherto unfamiliar country"—so unfamiliar is it that such a place is unknown to Queenslanders themselves, nor is it discoverable outside the pages of what in more senses than one is, as we have said, "a work of fiction." It has never been denied that North Queensland, in certain parts, has become the home of numbers of Continental Europeans, amongst whom, as amongst every race, there are a proportion of undesirables; but the unrelieved squalor and undiluted foreignisation described by the writer are certainly non-existent, whilst the miseries of the wet season are grossly exaggerated. The low death-rate of the population and the bright vigour of the children attending the schools, so consistently remarked upon by visitors from the South, are evidence of a very different state of things. "Eulaville," the name adopted by the author for his visionary sugar town, is represented as occupied almost solely by a polyglot crowd, amongst whom the strong self-respecting

Australian is absent. The legislation by which the sugar industry in Queensland is studiously regulated and organised is unknown in that fabled region. The mill itself, so far as it enters into the story, is different from all others—as, for example, the existence of open pans of boiling sugar, a trap for unwary feet, is unknown in modern practice, and an operating factory, remaining in the dead of night with a venal watchman as the sole occupant, is an absurdity. The writer apparently is unacquainted with the fact that the labour in the sugar mills is almost exclusively of "British" nationality. But perhaps the most misleading incident of all is that in which the whole of the "foreigners" band together to defeat a waterside strike, in which they are in no way interested, by forcefully and illegally attempting to load the steamers, in spite of police and shipping officials. This is really a travesty of what occurred some years ago in a port very much further south, when the farmers, almost exclusively Australians, went down to the wharf in orderly and lawful combination and thus secured the shipment of the raw sugar which the striking waterside workers had refused to handle. The foreign-born elements in this country have never been responsible for any approach to such conduct as that described by the writer of this book, nor are they ever at all likely to be. The brief quotation from a review which we give above is an example of the mischief likely to be wrought in unreflecting and prejudiced minds, already predisposed to think evil of a remote part of their own country.

In connection with the above, an interesting article appears in the "Launceston Examiner" of 23rd August. In the light of what is stated in the book, and of the recent articles by a special investigator commissioned by the Brisbane "Telegraph" to inquire into the state of affairs in the North Queensland sugar district, the Tasmanian journal gives a very judicial summing up of the position, as follows:—"The weight of evidence would seem to suggest that the Italian is by way of becoming a useful member of the community of the North, and of becoming ultimately a good, if somewhat emotional, Australian."—"The Australian Sugar Journal" for September.

Good Feeding Means Profitable Dairying.

Great improvement had been made in the class of stock bred in the Manning River district during the past twenty years, said Mr. J. A. Grant, manager of Wingham Butter Factory, N.S.W., addressing a recent gathering of local dairy farmers, but many farmers had failed to realise how much depended on the proper feeding of their stock. He predicted, however, that more attention would be given this aspect of dairying in the near future, as farmers were beginning to realise how uneconomical it was to keep even a champion milker if she were only half fed. Under these conditions such a large proportion of the feed went to keep the cow warm and to supply energy, that little was left for the production of milk.

Quoting as an example the operations of one particularly successful farmer he had observed for very many years, Mr. Grant stated that this man only reared sufficient calves to replace any cows that had passed their best, and the calf was only retained after careful examination of the breeding and production records of dam and sire, and after a check-up on its size, conformation, and health. The culled cows were spayed, and in a few months were fat enough to sell to the butcher. This was only possible because there was always an abundance of feed for the cattle. He was best able to judge as to the efficiency of this farmer's methods by the surprisingly regular amount of his monthly cheque.

This farm was not on rich country, but was rather steep and hilly. As a consequence of rearing so few calves, a comparatively large number of pigs were reared and fattened. The young pigs and breeding stock were grazed on rape in the winter and lucerne in the summer, with a very small quantity of milk and an abundance of water. When the young pigs were grown sufficiently they were fattened as rapidly as possible on maize and milk, which constituted an excellent ration. It had frequently happened that during a more or less dry year this farmer had made more money from his pigs alone than his neighbour, with a better farm, had made from his cows and pigs combined.

The explanation was to be found in better feeding as a result of better general management of the farm.

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

Summer Diarrhœa.

It is not many years since diarrhœa was the most frequent cause of death among babies. Diarrhœa was then most prevalent during the hot summer months, partly because milk rapidly becomes unwholesome when exposed to summer heat, but chiefly owing to the infection of milk from the growth of disease germs, which are always more or less prevalent during that season. Of recent years there has been an amazing lessening of the number of deaths caused by diarrhœal infections among babies. But some deaths from this cause still occur annually, and only by an intelligent use of our knowledge of their causes can these dangerous diseases be prevented.

Diarrhœa is the passage of frequent loose or watery motions. It is caused by the presence of some irritating material in the bowels. The bowels are trying to expel this, and so the motions are frequent. The contents of the bowel are being hurried through, and so they are watery. According to their cause, we may divide diarrhœas into food diarrhœas and infectious diarrhœas.

Food Diarrhœas.

These may be caused by simple overfeeding with food that is quite suitable, when not given in excess. This may occur at any time of year, but is more likely in summer, because babies are then often thirsty. Mothers sometimes fail to distinguish between hunger and thirst in babies, and yet it is easy. Thirst is satisfied by plain boiled water, and the baby should be given as much of this as he wants between feeds. Milk is a food, and thirst may induce an infant to take too much of it when he is not hungry, and so he gets upset.

Unsuitable foods may cause diarrhœa. There are so many kinds of unsuitable foods given to children and babies, that we shall not attempt any list of them. We may divide them into those which the mother gives, because she knows no better, and those which the babe, who has reached the crawling stage, finds for himself on the floor or elsewhere.

In hot weather milk rapidly becomes unwholesome from the growth of putrefactive organisms, unless the milk is kept cold. Especially is this likely to happen quickly if the milk has been obtained or handled in a dirty manner. If we remember these three causes of food diarrhœa in babies, their prevention is simple.

Treatment of Food Diarrhœas.

This also is simple. It is usually wise to give a teaspoonful of castor oil at the beginning to clear out the irritating material. At the same time we completely cease giving the babe any milk. He may drink as much very weak barley water, which may be slightly sweetened, as he likes. After twenty-four hours he should be distinctly better, but should

be kept on the barley water for another day if necessary until the motions begin to improve. He may then be given whey made with junket tablets. The whey is allowed to drip through cheese-cloth without any squeezing. Give nothing else to the babe under nine months. The babe over nine months may, if he is hungry, have some water-sago, or water-arrowroot, perhaps flavoured with a trace of marmite, or if he has teeth, a small piece of baked bread. No cow's milk must be given until the motions are much improved, and then only a small spoonful or two with each feed. If this is well digested, the quantity must be gradually increased. If the baby is breast-fed it is not necessary to diet him so strictly, and small feeds of breast milk may be given once or twice daily as the baby improves, instead of giving whey.

Infectious Diarrhœas.

These are much more serious. The infant may be very ill at the beginning, and medical advice should be sought at once. Sometimes the disease is deceitfully mild at first, but does not improve with simple treatment. Therefore, if the treatment for food diarrhœa is not followed by improvement within twenty-four hours, to seek medical advice is the only safe course. Especially is this necessary when the passage of blood and slime with straining shows that it is a case of dysentery.

The Prevention of Infectious Diarrhœas.

The responsibility for this rests with the mother. Breast-fed babies are much safer than those on the bottle. Therefore, we do not wean babies during the hottest months, if we can help it. The infection may be conveyed to the baby's food by dirty fingers, but more commonly is conveyed by flies. All milk should be scalded, unless pasteurised and in sealed vessels. It must be kept cool and most carefully protected from flies. The bottles and teats used by artifically-fed infants must be boiled, and afterwards most carefully shielded from flies. Flies are fond of alighting on the baby's dummy—we regret to say that these horrible things are still used by some mothers. The best safeguard for these babies is to burn the dummy.

ILL-NOURISHED CHILDREN.

THE skilled observer may see poorly-nourished children wherever he goes. Fortunately, they are usually fewer in number than the well-nourished children, but there are many of them. Their number varies in different places and at different times, but they are always present. There are many causes of poor nutrition, but in all but a few the cause is simply defective diets. By this we do not mean that the children do not get enough food. They probably get as much as they will eat; they may even get expensive foods, but they do not get the right sort of food. Their mothers have never received a right education and are not to be blamed for want of knowledge which no one has taught them. They are not to be blamed, but their children suffer all the same.

There is a widespread belief that the important foods are meat, white bread, butter, and sugar, and that all other foods are extras. Of the five necessary vitamins, meat contains only one, while bread and sugar contain none, and butter, which is valuable for its vitamins,

is expensive and is being replaced by margarine. So long as times are good most people take a large variety of foods, and these often supply all that is needed in the diet; but when times are bad and thousands are on relief wages, it is only natural that mothers should concentrate on what they think the important foods. They satisfy their children's appetites with foods on which really good health is impossible. There is no starvation, but much bad feeding. Poverty is not the cause. The cause is want of knowledge, the evil effects of which are made more dangerous by want of money. The foods that are essential to children's health are only too often cut out because the mother thinks they are not important, and therefore she cannot afford to buy them. Meanwhile she spends money unnecessarily on foods of inferior value.

Milk the Most Important Food.

The most important of foods for children is milk, and this is often the first to be cut out. In some places poorly-nourished children have become very numerous. It is sad to see so many of the next generation being spoilt in the making—so many that will never grow strong men and women, but will help to fill our hospitals, when in later life they fall victims to all kinds of diseases—so many that will fall easy victims to tuberculosis, or become hopelessly crippled with chronic rheumatism. The condition of their teeth will be such that all the dentists in Queensland working overtime, Sundays and holidays included, will not be able to do what is necessary. Every child under six should have a pint of good milk in some form or another daily. Every child over six should have at least half a pint, but a whole pint would be better. As it is, many families are given only a little condensed milk, or some powdered skimmed milk, in large quantities of water—a mere pretence of proper nourishment.

What can we propose for this great evil? Firstly, we must dispel this want of knowledge. Out Infant Welfare Service is responsible for all children under school age, and is doing its best to help their mothers. This work is difficult and slow, and we cannot reach mothers not within easy distance of our centres. A large number of new branch clinics are much needed. The next generation of mothers will, we hope, have been better educated before they leave school. Secondly, there are ways in which we can directly encourage the increased consumption of milk. These will be explained in our next article.

SIMPLE COOKERY.

BAKED ORANGE PUDDING.

Materials—1 slice bread; 2 eggs; 1 pint milk; 1 dessertspoonful butter; 1 dessertspoonful sugar; 2 oranges.

Utensils—Pie dish; basin; saucepan; whisk.

Method—

1. Look to the oven and grease pie dish.
2. Place milk on to boil.
3. Put bread into pie dish and pour boiling milk over it.
4. Beat egg and sugar together.
5. Add grated orange rind and juice to egg.
6. Pour over the soaked bread.
7. Add a little butter.
8. Bake in moderate oven. Place dish in cold water.
9. Serve cold.

STEAMED GINGER PUDDING.

Materials—½ lb. flour; 3 oz. dripping; 3 oz. sugar; ½ cup milk; ½ cup treacle; 1 tablespoonful ginger; 1 dessertspoonful each of cinnamon and spice; 1 teaspoonful soda.

Utensils—Bowl; sieve; wooden spoon; basin; paper; steamer.

Method—

1. Cream dripping and sugar; add milk and treacle; mix well.
2. Add flour sifted with spice, ginger, salt, and soda.
3. Pour into a greased basin; cover with greased paper.
4. Steam for 3 hours; turn out; serve with sweet, white sauce.

STEAMED URNEY PUDDING.

Materials—¼ lb. flour; 3 oz. butter or dripping; 2 oz. sugar; 2 eggs; ½ teaspoonful carbonate soda; 1 tablespoonful seeded jam.

Utensils—Steamer; basin; greased paper; wooden spoon; whisk.

Method—

1. Put water on to boil.
2. Beat butter and sugar together.
3. Add egg well beaten with jam.
4. Sift in flour and baking soda.
5. Steam 1½ hours.
6. Serve with white sauce or jam.

TAPIOCA (BOILED).

Materials—2 tablespoonfuls tapioca; ½ pint milk; ½ pint water; 1 dessertspoonful sugar.

Utensils—Basin; saucepan.

Method—

1. Wash tapioca well; cover with water.
2. Soak it 1 hour.
3. Put it into a saucepan; add milk and sugar.
4. Cook till clear and tender; serve with milk or cream.

TAPIOCA CREAM.

Materials—¼ cup tapioca; 1 pint milk; 2 eggs; 2 tablespoonsful sugar; essence of vanilla.

Utensils—Basin; saucepan; wooden spoon; whisk.

Method—

1. Soak the tapioca in milk or water over night.
2. Place over the fire and boil till clear.
3. Beat yolks of eggs and sugar well together.
4. Add to the tapioca; allow to thicken, but do not boil; whisk whites to a stiff froth; add half to the mixture when cold; beat well.
5. Turn into glass dish; decorate with coloured cocoanut and remaining white of egg; serve with stewed fruit.

COCOANUT BISCUITS.

Materials for Biscuit.—¼ lb. butter; ¼ lb. sugar; essence or grated lemon rind; yolks 2 eggs; ½ lb. flour.

Materials for Top—Whites 2 eggs; ¼ lb. icing sugar; ¼ lb. cocoanut.

Utensils—Bowl; wooden spoon; sieve; cutter, baking tin.

Method—

1. Cream butter and sugar together; add essence and yolks of eggs; beat well.
2. Sift in flour; turn out on floured board and knead.
3. Roll out and cut into biscuits with a round cutter.
4. Spread cocoanut mixture on top and bake on a greased tin in a moderate oven half an hour.

Cocoanut Mixture—Whip whites of eggs until stiff; add cocoanut and icing sugar until a thick paste is formed.

GINGERBREAD.

Materials—¾ lb. flour; pinch of salt; ¼ lb. butter or dripping; ¼ lb. sugar; 2 teaspoonfuls ginger; 1 teaspoonful mixed spice; ½ cup treacle; ½ teaspoonful soda; 2 eggs; ¼ cup milk.

Utensils—Sieve; bowl; saucepan; basin; whisk; cup; wooden spoon; baking tin.

Method—

1. Sift flour, salt, ginger, and spice into a bowl.
2. Heat the butter or dripping, sugar, and treacle, stirring until the mixture is smooth.
3. Beat eggs well; slightly heat the milk; dissolve soda in it.
4. Mix all wet ingredients together.
5. Add to the dry ingredients; stir until smooth.
6. Pour into a greased tin; bake in a moderate oven for about 1¼ hours.

LEMON BUNS.

Materials—2 oz. butter; 2 oz. sugar; 1 egg; ½ cup milk; lemon essence or grated rind; ½ lb. flour; 1 teaspoonful cream of tartar; ½ teaspoonful soda.

Utensils—Bowl; wooden spoon; cup; grater; sieve; baking tin.

Method—

1. Beat butter and sugar to a cream; add essence or rind, and egg.
2. Beat well; add milk and flour sifted with cream of tartar and soda.
3. Take pieces of mixture and form into balls; brush over with egg and milk, and sprinkle with pink sugar.
4. Put on greased tin; bake till slightly browned.

NUT FINGER BISCUITS.

Materials—¼ lb. butter; 2 oz. sugar; ½ lb. flour; 1 small teaspoonful baking powder; 1 egg; ¼ lb. icing sugar; 1 oz. nuts.

Utensils—Bowl; rolling-pin; knife; pastry board; plate; wooden spoon.

Method—

1. Attend to the oven.
2. Beat butter and sugar to a cream.
3. Add yolk of egg and beat well.
4. Sift in flour and making powder.
5. Mix all well together until crumbly.
6. Add 1 or more tablespoonfuls of boiling water to blend mixture into a stiff dough.
7. Beat icing sugar and white of egg together.
8. Chop nuts up finely.
9. Roll out paste to less than ¼-inch thickness; cut into a square.
10. Spread over icing and sprinkle with nuts.
11. Cut into finger lengths 1 inch by 3 inches.
12. Bake on greased tray in moderate oven.

SHORTBREAD.

Materials—4 oz. butter; 2 oz. icing sugar; ½ lb. flour.

Utensils—Bowl; sieve; rolling-pin; baking dish.

Method—

1. Cream sugar and butter together till white.
2. Add sifted flour.
3. Turn out on floured board; knead; cut into halves; roll out; pinch edges; put on baking dish.
4. Bake in a slow oven for 1 hour.

Note.—The amount of flour may be reduced slightly.

SPONGE ROLL.

Materials—3 eggs; ½ cup sugar; 1 cup flour; 1 teaspoonful baking-powder; 2 tablespoonfuls jam; 1 tablespoonful water; icing sugar; dripping or butter for greasing tin.

Utensils—Bowl; whisk; sieve; jam-roll tin; cloth.

Method—

1. Break eggs into a bowl.
2. Add sugar; whisk till thick; add water.
3. Add flour mixed with baking-powder.
4. Bake in greased jam-roll tin.
5. When cooked turn out on clean cloth; roll up quickly; unroll; spread with jam; roll up; sprinkle with icing sugar.

BREADMAKING.

To make Yeast.

Materials—1 potato; 2 tablespoonfuls loose hops; 1 tablespoonful sugar; 1 tablespoonful flour; 3 cups of water.

Utensils—Saucepan; basin; cup; strainer; bottle.

Method—

1. Wash potato; slice it into a saucepan.
2. Cover with water; boil till soft.
3. Put hops into a basin; add 1 cup of boiling water.
4. Cover; let cool.
5. Mix sugar and flour together with water.
6. Add hops, potatoes, and remainder of water.
7. Strain; bottle; tie cork down securely.

To make Bread.

Materials—1 lb. flour; ¼ cup yeast; ½ pint tepid water; ½ teaspoonful salt.

Utensils—Bowl; tin; knife.

Method—

1. Sift flour into a bowl.
2. Mix yeast and half water together.
3. Make a well in centre of flour.
4. Pour in yeast and rest of water.
5. Mix into dough; cover with a cloth.
6. Let stand in a warm place for 6 hours; add salt.
7. Knead for 30 minutes; form into loaves; let stand to rise.
8. Bake in hot oven 40 minutes.

WHOLEMEAL BREAD.

Materials—1 lb. wholemeal; ¼ cup yeast; ½ cup lukewarm water; ¼ teaspoonful salt.

Utensils—Bowl; cup; knife; tins.

Method—

1. Put whole meal into a bowl.
2. Mix into a smooth, soft dough, with yeast and water.
3. Stand aside in a warm place for 3 hours; add salt.
4. Turn out on a board; knead; divide into pieces; form into loaves.
5. Place in greased tins; stand for an hour.
6. Bake in a moderate oven.

Compressed Yeast.

Compressed yeast, a putty-like mass of yeast plants, may be purchased; it will only keep for two or three days; if it is not possible to use it at once, it should be kept in a cool, dry place.

BREAD MADE WITH COMPRESSED YEAST.

Materials—1 lb. flour; ½ oz. compressed yeast; ½ teaspoonful salt; ½ teaspoonful sugar; about ½ cup of warm water.

Utensils—Sieve; basin; wooden spoon; board; knife; tin.

Method—

1. Sift flour into a warmed basin; crumble yeast into middle of flour.
2. Sprinkle sugar over yeast; add 2 tablespoonfuls of lukewarm water.
3. Stir until the centre of the flour is like batter; stand in a warm place for 10 to 12 minutes.
4. Sprinkle salt over dough; mix well, adding sufficient warm water to form dough.
5. Turn out on a floured board; knead well.
6. Return to warmed basin; cut across surface with a floured knife.
7. Cover and let stand in a warm place for 35 to 40 minutes.
8. Turn out on a floured board; knead it into shape; put into a greased tin, leaving about one-third of the space for rising; stand in a warm place for 10 minutes.
9. Put into a hot oven for 5 to 10 minutes; decrease heat; allow 30 to 40 minutes to complete the baking.

Note—The whole process takes from 1¾ to 2 hours.

BILLY BREAD.

Materials—1 cup flour; 1 cup wheatmeal; 2 teaspoonfuls baking powder; ½ teaspoonful salt; 1 dessertspoonful butter or dripping; 1 dessertspoonful sugar; ½ cup treacle; ½ cup milk; dripping to grease tins.

Utensils—Bowl; cup; fork; board; groats or other tins with lids or billy can; skewer.

Method—

1. Put wheatmeal and flour sifted with baking powder and salt into a bowl.
2. Add sugar; work butter or dripping in with the tips of the fingers.
3. Make a well in the dry ingredients; pour in the milk and treacle well mixed together.
4. Work into a damp dough with a fork; turn out on a slightly floured board; knead for 1 minute.
5. If necessary divide the dough; put into well-greased tins or billy can, leaving not less than one-third of the space for rising.
6. Put lids on; bake in a moderate oven for 1 to 1½ hour; the time will depend on the size of the tin or billy can; test with a skewer.

Note—Nuts, shelled and cut up, sultanas, dates, or other dried fruit may be used with this mixture to make nut loaf, date loaf, &c.

NUT BREAD.

Materials—2 cups self-raising flour; 1 cup brown sugar; 1 cup milk; 1 egg; ½ cup chopped nuts; 1 teaspoonful salt.

Utensils—Bowl; wooden spoon; baking tin with lid.

Method—

1. Grease tin and look to the oven.
2. Sift flour and salt into a bowl.
3. Add sugar and nuts.
4. Make well in centre; break in the egg and add milk.
5. Mix all together quickly.
6. Half fill coffee tin and bake with lid on for 1 hour in moderate oven.

Orchard Notes for January.

THE COASTAL DISTRICTS.

ALL orchards, plantations, and vineyards should be kept well cultivated and free from weed growth; in the first place, to conserve the moisture in the soil, so necessary for the proper development of all fruit trees and vines; and, secondly, to have any weed growth well in hand before the regular wet season commences. This advice is especially applicable to citrus orchards, which frequently suffer from lack of moisture at this period of the year if the weather is at all dry, and the young crop of fruit on the trees is injured to a greater or less extent in consequence.

Pineapple plantations must also be kept well worked and free from weeds, as when the harvesting of the main summer crop takes place later on, there is little time to devote to cultivation. If this important work has been neglected, not only does the actual crop of fruit on the plants suffer, but the plants themselves receive a setback.

Banana plantations should be kept well worked, and where the soil is likely to wash badly, or there is a deficiency of humus, a green crop for manuring may be planted. Should the normal wet season set in, it will then soon cover the ground without injury to the banana plants. When necessary, banana plantations should be manured now, using a complete manure rich in potash and nitrogen. Pineapples may also be manured, using a composition rich in potash and nitrogen, but containing no acid phosphate (superphosphate) and only a small percentage of bonemeal, ground phosphatic rock, or other material containing phosphoric acid in a slowly available form.

Bananas and pineapples may still be planted, though it is somewhat late for the former in the more southern parts of the State. Keep a good lookout for pests of all kinds, such as Maori on citrus trees, scale insects of all kinds, all leaf-eating insects, borers, and fungus pests generally, using the remedies recommended in Departmental publications.

Fruit fly should receive special attention, and on no account should infested fruit of any kind be allowed to lie about on the ground to become the means of breeding this serious pest. If this is neglected, when the main mango crop in the South and the early-ripening citrus fruits are ready, there will be an army of flies waiting to destroy them.

Be very careful in handling and marketing of all kinds of fruit, as it soon spoils in hot weather, even when given the most careful treatment. Further, as during January there is generally more or less of a glut of fresh fruit, only the best will meet with a ready sale at a satisfactory price.

Grapes are in full season, and in order that they may be sold to advantage they must be very carefully handled, graded, and packed, as their value depends very much on the condition in which they reach the market and open up for sale. Well-coloured fruit, with the bloom on and without a blemish, always sells well, whereas badly coloured, immature, or bruised fruit is hard to quit.

One of the greatest mistakes in marketing grapes is to send the fruit to market before it is properly ripe, and there is no better way to spoil its sale than to try and force it on the general public when it is sour and unfit to eat.

Bananas for sending to the Southern States require to be cut on the green side, but not when they are so immature as to be only partially filled. The fruit must be well filled but show no sign of ripening; it must be carefully graded and packed and the cases marked in accordance with the regulations under the Fruit Cases Acts and forwarded to its destination with as little delay as possible.

Pineapples should be packed when they are fully developed, which means that they contain sufficient sugar to enable the fruit to mature properly. Immature fruit must not be marketed, and if an attempt is made to do so the fruit is liable to seizure and the sender of the fruit to prosecution under the abovenamed regulations. Further, the fruit must be graded to size and the number of fruit contained in a case must be marked thereon. Immature fruit must not be sent. For canning, the fruit should be partly coloured; immature fruit is useless; and over-ripe fruit is just as bad. The former is deficient in colour and flavour and the latter is "winey" and of poor texture, so that it will not stand the necessary preparation and cooking.

Should there be a glut of bananas, growers are advised to try and convert any thoroughly ripe fruit into banana figs.

The fruit must be thoroughly ripe, so that it will peel easily, and it should be laid in a single layer on wooden trays and placed in the sun to dry. If the weather is settled, there is little trouble, but if there is any sign of rain the trays must be stacked till the weather is again fine, and the top of the stack protected from the rain. To facilitate drying, the fruit may be cut in half lengthways. It should be dried till a small portion rubbed between the finger and thumb shows no sign of moisture. It can be placed in a suitable box to sweat for a few days, after which it can be dipped in boiling water to destroy any moth or insect eggs that may have been laid on it during the process of drying and sweating. It is then placed in the sun to dry off any moisture, and when quite dry it should be at once packed into boxes lined with clean white paper. It must be firmly packed, when, if it has been properly dried, it will keep a considerable time. It can be used in many ways, and forms an excellent substitute for raisins, sultanas, currants, or other dried fruits used in making fruit cakes and other comestibles. Banana figs will be found useful for home consumption, and it is possible that a trade may be built up that will absorb a quantity of fruit that would otherwise go to waste.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

JANUARY is a busy month in the Granite Belt, and orchardists are fully occupied gathering, packing, and marketing the crop of midseason fruits, consisting of plums of several kinds, peaches, nectarines, pears, and apples. The majority of these fruits are better keepers and carriers than those that ripen earlier in the season; at the same time, the period of usefulness of any particular fruit is very limited, and it must be marketed and disposed of with as little delay as possible.

With the great increase in production, owing to the large area of new orchards coming into bearing and the increasing yields of those orchards that have not come into full profit, there is not likely to be any market for immature or inferior fruit. There will be ample good fruit to fully supply the markets that are available and accessible. Much of the fruit will not carry far beyond the metropolitan market, but firm-fleshed plums, clingstone peaches, and good firm apples should stand the journey to the Central District, and, if they are very carefully selected, handled in a manner to prevent any bruising, and properly graded and packed, they should carry as far as Townsville. Growers must remember that, given a market fully supplied with fruit, only such fruit as reaches that market in first-class condition is likely to bring a price that will pay them; consequently the grower who takes the trouble to send nothing but perfect fruit, to grade it for size and colour, to pack it carefully and honestly, placing only one-sized fruit, of even quality and even colour, in a case and packing it so that it will carry without bruising, and, when opened up for sale, will show to the best advantage, is pretty certain of making good. On the other hand, the careless grower who sends inferior badly graded, or badly packed fruit is very likely to find when the returns for the sale of this fruit are to hand that after paying expenses there is little, if anything, left. The expense of marketing the fruit is practically the same in both cases.

Then why "spoil the ship for a ha'p'orth of tar" after you have gone to the expense of pruning, spraying, manuring, and cultivating your orchard? Why not try and get a maximum return for your labour by marketing your fruit properly? The packing of all kinds of fruit is a fairly simple matter, provided you will remember—

(1) That the fruit must be fully developed, but yet quite firm when gathered.

(2) That it must be handled like eggs, as a bruised fruit is a spoilt fruit, and, when packed with sound fruit, spoils them also.

(3) That only one-sized fruit, of an even degree of ripeness and colour, must be packed in a case.

(4) That the fruit must be so packed that it will not shift, for if it is loosely packed it will be so bruised when it reaches its destination that it will be of little value. At the same time, it must not be packed so tightly as to crush the fruit.

If these simple rules are borne in mind, growers will find that much of the blame they frequently attribute to the fruit merchants or middlemen is actually the result of their own lack of care. Fruit that opens up in the pink of condition sells itself, whereas any fruit that opens up indifferently is hard to sell on any except a bare market, and on a glutted market is either unsaleable or realises such a poor price that the grower is frequently out of pocket and would have been better off had he not attempted to market it.

If spraying with arsenate of lead and systematic bandaging has been properly carried out, there will be comparatively few codlin moths to destroy the later ripening pip fruits; but if these essential operations have been neglected or carelessly carried out a number of moths will hatch out and the eggs laid by them will turn to larvæ that will do much damage, in some cases even more than that caused by the first broods that attack the fruit as soon as it is formed. Where there is any likelihood, therefore, of a late crop of moths, spraying with arsenate of lead must be continued if the late crop of pip fruits is to be kept free from this serious pest.

Fruit fly must be systematically fought, and on no account must any fly-infected fruit be allowed to lie about on the ground and breed this pest, to do further damage to the later ripening fruits.

Citrus orchards will need to be kept well cultivated in the drier and warmer parts of the State, and, where necessary, the trees should be irrigated. If scale insects are present, the trees should be either sprayed or, better still, treated with hydrocyanic acid gas.

Western grapes are in full season, and if they are to be sent long distances by rail then they are all the better to be cut some hours before they are packed, as this tends to wilt the stems and keep the berries from falling off in transit. The fruit must be perfectly dry when packed, and should be as cool as possible. It must be firmly packed, as a slack-packed case always carries badly and the fruit opens up in a more or less bruised condition.

Farm Notes for January.

FIELD.—The main business of the field during this month will be ploughing and preparing the land for the potato and other future crops, and keeping all growing crops clean. Great care must be exercised in the selection of seed potatoes to ensure their not being affected by the Irish blight. Never allow weeds to seed. This may be unavoidable in the event of long-continued heavy rains, but every effort should be made to prevent the weeds coming to maturity. A little maize may still be sown for a late crop. Sow sorghum, imphee, Cape barley, vetches, panicum, teosinte, rye, and cowpeas. In some very early localities potatoes may be sown but there is considerable risk in sowing during this month and it may be looked upon merely as an experiment. Plant potatoes whole. Early-sown cotton will be in bloom.

On coastal and intercoastal scrub districts, where recently burnt-off scrub lands are ready for the reception of seed of summer-growing grasses, sowing may commence as soon as suitable weather is experienced. Much disappointment may be saved, and subsequent expenditure obviated, by ensuring that only good germinable grass seed is sown, of kinds and in quantities to suit local conditions, the circumstances being kept in mind that a good stand of grass is the principal factor in keeping down weeds and undergrowth.

In all districts where wheat, barley, oats, canary seed, and similar crops have recently been harvested, the practice of breaking up the surface soil on the cropped areas should invariably be adopted. Soil put into fit condition in this way will "trap" moisture and admit of the rains percolating into the subsoil, where the moisture necessary for the production of a succeeding crop can be held, provided attention is given to the maintenance of a surface mulch, and to the removal, by regular cultivation, of volunteer growths of all kinds. If not already seen to, all harvesting machinery should be put under cover, overhauled, and the woodwork painted where required.

Where maize and all summer-growing "hoed" crops are not too far advanced for the purpose, they should be kept in a well-cultivated condition with the horse hoe. Young maize and sorghum crops will derive much benefit by harrowing them, in the same direction as the rows are running, using light lever harrows with the tines set back at an angle to obviate dragging out of plants, but the work should not be done in the heat of the day.

Quick-maturing varieties of maize and sorghum may still be sown in the early part of the month in coastal areas where early frosts are not expected.

Succession sowings may be made of a number of quick-growing summer fodder crops—Sudan grass, Japanese and French millet, white panicum, and liberty millet (panicum). In favourable situations, both "grain" and "saccharine" sorghums may still be grown; also maize, for fodder purposes.

Fodder conservation should be the aim of everyone who derives a living from stock, particularly the dairyman; the present is an important period to plan cropping arrangements. Exclusive of the main crops for feeding-off (when fodder is suitable for this purpose), ample provision should be made for ensilage crops to be conserved in silo or stack. As natural and summer-growing artificial grasses may be expected to lose some of their succulence in autumn, and more of it in winter and early spring, the cropping "lay-out" to provide a continuity of succulent green fodder throughout the season calls for thorough and deep cultivation and the building up of the fertility and moisture-holding capacity of the soil. Planter's friend (sorghum) may be sown as a broadcast crop at the latter end of the month for cutting and feeding to cattle in the autumn and early winter. Strips of land should be prepared also for a succession sowing about the second week in February, and for winter-growing fodder crops.

PLATE 330.—EMUS ON DOWNS COUNTRY, HUGHENDEN DISTRICT.
[*Photo. by courtesy of Lands Department.*

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF OCTOBER, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING OCTOBER, 1934, AND 1933, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Oct.	No. of Years' Records.	Oct., 1934.	Oct., 1933.
North Coast.	In.		In.	In.
Atherton	0·92	33	0·91	1·86
Cairns	2·13	52	1·26	2·40
Cardwell	2·07	62	2·10	2·58
Cooktown	1·05	58	1·37	1·03
Herberton	0·99	48	0·58	1·86
Ingham	1·95	42	1·99	2·84
Innisfail	3·21	53	3·03	15·14
Mossman Mill	3·01	21	3·62	2·09
Townsville	1·38	63	0·40	1·20
Central Coast.				
Ayr	0·98	47	0·30	0·85
Bowen	1·05	63	0·44	2·02
Charters Towers	0·72	52	0·91	1·92
Mackay	1·66	63	3·65	1·45
Proserpine	1·72	31	0·89	2·76
St. Lawrence	1·77	63	2·06	4·66
South Coast.				
Biggenden	2·40	35	3·39	7·52
Bundaberg	2·11	51	2·89	4·48
Brisbane	2·54	83	1·34	3·82
Caboolture	2·52	47	1·94	4·36
Childers	2·69	39	3·87	8·18
Crohamhurst	3·29	41	..	5·99
Esk	2·53	47	1·76	1·77
Gayndah	2·40	63	3·26	4·87
Gympie	2·72	64	2·66	5·33
Kilkivan	2·62	55	3·55	3·76
Maryborough	2·78	63	3·88	8·28
Nambour	3·01	38	4·81	6·53
Nanango	2·25	52	1·47	1·45
Rockhampton	1·78	63	3·21	4·07
Woodford	2·56	47	1·60	3·72

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Oct.	No. of Years' Records.	Oct., 1934.	Oct., 1933.
Central Highlands.	In.		In.	In.
Clermont	1·32	63	2·09	2·15
Gindie	1·36	35	3·11	2·10
Springsure	1·64	65	2·74	2·69
Darling Downs.				
Dalby	2·08	64	1·45	5·73
Emu Vale	2·19	38	2·98	2·91
Hermitage	1·90	28	2·26	1·77
Jimbour	1·90	46	1·33	2·45
Miles	2·03	49	2·62	5·67
Stanthorpe	2·55	61	3·98	3·18
Toowoomba	2·55	62	3·12	2·67
Warwick	2·30	69	2·53	2·62
Maranoa.				
Roma	1·75	60	2·64	3·35
State Farms, &c.				
Bungeworgorai	1·44	20	2·75	3·09
Gatton College	1·99	35	1·95	1·56
Kairi	1·04	20	..	1·82
Mackay Sugar Experiment Station	1·39	37	2·14	1·29

J. H. HARTSHORN, Acting Divisional Meteorologist.

CLIMATOLOGICAL TABLE—OCTOBER, 1934.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·95	85	69	87	17,18,25	59	1	112	3
Herberton	..	79	59	85	17	50	2	58	2
Rockhampton	30·08	83	63	89	5, 28	55	5	321	9
Brisbane	30·13	76	59	85	28	50	23	134	8
Darling Downs.									
Dalby	30·10	79	53	87	23	37	2	145	7
Stanthorpe	..	69	47	78	7, 23	29	2	398	11
Toowoomba	..	71	52	78	28	37	2	312	8
Mid-Interior.									
Georgetown	29·94	96	70	99	9,13,14, 15, 16, 17, 18, 19, 20, 26	61	8, 18	16	2
Longreach	30·00	91	61	100	14	44	2	55	3
Mitchell	30·05	81	54	91	24	34	2, 3	326	7
Western.									
Burketown	29·94	92	72	99	28	60	4	7	1
Boulia	29·98	91	63	107	24	46	2	17	2
Thargomindah	30·02	83	59	99	23	43	2	117	6

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

MOONRISE.

	December. 1934.		January. 1935.		Dec., 1934.	Jan., 1935.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	4·49	6·33	5·0	6·50	12·42	12·50
2	4·49	6·33	5·1	6·50	1·14	1·31
3	4·49	6·34	5·1	6·50	1·44	2·26
4	4·49	6·35	5·2	6·51	2·20	3·28
5	4·50	6·36	5·2	6·51	2·59	4·35
6	4·50	6·36	5·3	6·51	3·48	5·41
7	4·50	6·37	5·3	6·51	4·46	6·52
8	4·50	6·38	5·4	6·52	5·49	8·3
9	4·50	6·38	5·4	6·52	6·56	9·6
10	4·51	6·39	5·5	6·52	8·4	10·13
11	4·51	6·39	5·6	6·52	9·13	11·15
						p.m.
12	4·51	6·40	5·7	6·52	10·19	12·17
13	4·51	6·40	5·8	6·52	11·24	1·18
					p.m.	
14	4·52	6·41	5·9	6·51	12·24	2·20
15	4·52	6·41	5·10	6·51	1·26	3·18
16	4·52	6·42	5·10	6·51	2·26	4·14
17	4·52	6·43	5·11	6·51	3·27	5·5
18	4·53	6·44	5·12	6·51	4 28	5·54
19	4·53	6·44	5·13	6·51	5·28	6·37
20	4·53	6·45	5·14	6·50	6'22	7·14
21	4·54	6·45	5·15	6·50	7'12	7·47
22	4·54	6·46	5·16	6·50	7·59	8·18
23	4·55	6·46	5·17	6·50	8·39	8·44
24	4·55	6·47	5·18	6·50	9·13	9·13
25	4·56	6·47	5·18	6·49	9·46	9·42
26	4·56	6·48	5·19	6·49	10·15	10·13
27	4·57	6·48	5·20	6 48	10·43	10·46
28	4·58	6·49	5·21	6·48	11·10	11·26
29	4.59	6,49	5·22	6·47	11'40	a.m.
30	4·59	6·50	5·23	6 47	a.m.	12·12
31	5·0	6·50	5·24	6·46	12·13	1·6

Phases of the Moon, Occultations, &c.

7 Dec.,	● New Moon	3 25 a.m.
13 ,,	☾ First Quarter	8 52 p.m.
21 ,,	○ Full Moon	6 53 a.m.
29 ,,	☽ Last Quarter	12 8 p.m.

Perigee, 9th December, at 6 p.m.
Apogee, 25th December, at 7.36 p.m.

Mercury will be in conjunction with the Moon at 5 a.m. on the 6th, 1 hour 12 minutes after rising.

Venus will be in conjunction with the Moon at midday on the 7th, but being only about 4 degrees east of the Sun will be unobservable to amateurs.

Saturn will be in conjunction with the Moon on the 11th, an hour and a-half after setting. Earlier in the evening the crescent Moon and the planet will form an interesting spectacle apparently amongst the stars near the eastern border of Capricornus.

On the 31st Mercury will be in superior conjunction with the Sun, but being 1 degree 44 minutes southward will not get actually behind it. Mercury will then be at a distance of about 36 million miles beyond the Sun.

The Moon's path in December will be as follows:—Commencing at 8 p.m. on the 1st, it will be apparently amongst the stars of Virgo about 5 degrees south of the celestial equator; at midday on the 3rd it will be passing Spica, about 3 degrees south of it, and at 8 p.m. the waning Moon will be a little further to the south-east. About midday on the 4th it will pass into Libra and be in it till an early hour on the 6th; about 11 p.m. on the 7th it will pass into Sagittarius, but being new will be unobservable; about 8 a.m. on the 10th it will pass into Capricornus; at 11 p.m. on the 11th into Aquarius; at 9 p.m. on the 13th into Pisces; at 4 p.m. on the 16th into Aries; before noon on the 18th into Taurus; before midday on the 21st into Gemini; at 5 p.m. on the 23rd into Cancer; at 10 a.m. on the 25th into Leo, passing about 2 degrees south of Regulus at 10 a.m. on the 26th. It will pass again into Virgo at 4 p.m. on the 28th.

Mercury rises at 3.54 a.m. on 1st December and only 38 minutes before the Sun on the 15th.

Venus rises 12 minutes after the Sun and sets 14 minutes after it on the 1st; on the 15th it rises 26 minutes after the Sun and sets 29 minutes after it.

Mars rises at 1.4 a.m. and sets at 12.54 p.m. on the 1st; on the 15th it rises at 12.30 a.m. and sets at 12.31 p.m.

Jupiter rises at 3.15 a.m. and sets at 4.27 p.m. on the 1st; on the 15th it rises at 2.27 a.m. and sets at 3.45 p.m.

5 Jan.	● New Moon	3 20 p.m
12 ,,	☾ First Quarter	6 55 a.m.
20 ,,	○ Full Moon	1 44 a.m.
28 ,,	☽ Last Quarter	5 59 a.m.

Perigee, 6th January, at 9.42 p.m.
Apogee, 22nd January, at 8.0 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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David Whyte, Government Printer, Brisbane.

VOLUME XLII

QUEENSLAND AGRICULTURAL JOURNAL

Issued by direction of

The Hon. the Secretary for Agriculture

Edited by J. F. F. REID

JULY to DECEMBER, 1934

By Authority: DAVID WHYTE, Government Printer, Brisbane.

Supplement to the "Queensland Agricultural Journal," March, 1935.

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DAVID WHYTE, Government Printer, Brisbane.